ABSTRACT

Zarina A. Ahmad, BLACK STUDENTS MATTER: HOW TEACHERS EQUITABLY ENGAGE AFRICAN AMERICAN STUDENTS IN UNDERSTANDING CONCEPTUAL MATHEMATICS (Under the direction of Dr. Matthew Militello) Department of Educational Leadership, December, 2023).

In this participatory action research (PAR) study, I sought to understand how teachers implemented equitable and culturally responsive academic discourse to support African American students during mathematics instruction. Working with a group of teachers in a co-practitioner researcher (CPR) group, I examined to how teachers effectively planned and implemented culturally responsive academic discourse routines during mathematics instruction, engaged in plan-do-study-act cycles of inquiry, used protocols, and reflected on their pedagogical practices. In conducting evidence-based observations and post-observation conversations, teachers shifted their practices to be equitable and culturally responsive. Using qualitative methods to analyze data from documents, observation tools, coaching conversations, reflective memos, and artifacts from community learning exchange protocols (CLE), the findings are: (1) Teachers changed their academic discourse routines to foster equitable access; (2) observations and post-observation conversations facilitated by the school leader supported teachers to shift to culturally responsive practices. The research provides more insight for the teachers, the school, and the district on how to foster equitable engagement of African American students in conceptual mathematics and is useful to other leaders and teachers at site levels who want to engage in action research to understand and shift their instructional practices.

BLACK STUDENTS MATTER: HOW TEACHERS EQUITABLY ENGAGE AFRICAN AMERICAN STUDENTS IN UNDERSTANDING CONCEPTUAL MATHEMATICS

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DEDICATION

For Timothy, Ayinde Malik, Nnamdi, Nalani, Ajani, Nikosi, Zara, Ayo

and

Future Descendants

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CHAPTER 1: NAMING AND FRAMING THE FOCUS OF PRACTICE

In today's world, economic access and full citizenship depend crucially on math and science literacy. I believe that the absence of math literacy in urban and rural communities throughout this country is an issue as urgent as the lack of registered Black voters in Mississippi was in 1961.

—Robert Moses

Conceptual understanding of mathematics is a critical civil right as math is a gateway or a gatekeeper to higher education and a better quality of life (Moses, 2001). To ensure all students have an equitable opportunity to engage in developing conceptual mathematical knowledge, I examined to what extent teachers implemented equitable and culturally responsive academic discourse to support African American students during mathematics instruction. With this understanding, the overarching research question for this study is: *How do third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction?*

Almost all twenty-first century professions require mathematical skills that include critical thinking, logic, and reasoning. However, in our society, in particular African Americans are left out of professional opportunities due to lack of education in mathematics (Delpit, 2012). Many educators and parents focus on reading and writing literacy and view math literacy as optional (Moses, 2001). Some people in our society say understanding mathematical concepts is not for all people or that some people are just not good at mathematics (Rogers, 2017; Willingham, 2009). Instead, could the reason for lower math achievement be that effective, conceptual mathematics education has not been a teaching priority?

For decades, many teachers have understood mathematics education to mean teaching algorithms to solve problems (National Council of Teachers of Mathematics, 2014). Most curricular programs for mathematics use procedural lessons with steps for solving mathematical

problems. Unfortunately, mere problem-solving does not ensure the understanding of mathematical concepts. According to the National Council of Teachers of Mathematics (2014), "conceptual understanding, (i.e., the comprehension and connection of concepts, operations, and relations) establishes the foundation, and is necessary, for developing procedural fluency (i.e., the meaningful and flexible use of procedures to solve problems)" (p. 7). In 2009-10, the National Governors Association and Council of Chief State School Officers created the Common Core standards, which shifted mathematics curriculum and testing requirements; instead of simply having an answer, students have to explain how they solved problems (www.corestandards.org, 2020). As a result, teaching practices need to shift to increase conceptual mathematical understanding. In discussing the focus of practice for this project and study, I provide a rationale for the importance of the study and discuss the assets and challenges to the focus of practice at an elementary school in an urban California school district.

Focus of Practice

In this participatory action research study, I invited a group of teachers at Piedmont Avenue Elementary School in Oakland, California to examine how they implemented equitable and culturally responsive academic discourse to support African American students. The school involved in the study is a Title One urban school in the Oakland Unified School District (OUSD) in California. According to the 2019 School Accountability Report Card (SARC), of the 342 students the reported student race and ethnicity is 49% African American, 8.5% Asian, 17.9% Latino, 8.5% European American, 0.9% Native American, 1.5% Filipino, .6% Pacific Islander, and 9.1% two or more races. The SARC reports that 72.4% of the students are socioeconomically disadvantaged, 19.4% are English language learners, 14.1% are students with disabilities, .3% are foster youth and .6% are unsheltered. African American students are the

most statistically significant subgroup at the school level. I had observed many of the teachers previously as a part of learning how to conduct equitable observations in math classrooms. I observed a pattern in which students could not fully explain their thinking about how they solved a problem, and they could not speak about math concepts. In particular, students of color could not respond to higher-level questions. Based on conversations with a group of teachers about these observations, we considered the focus of practice (FoP) on mathematics instruction. We needed a strong knowledge base and more intentional strategies to implement equitable and culturally responsive academic discourse to support and engage African American students.

Embedded in the research is an equity focus on how teachers view African American students during mathematics instruction. As we aimed to analyze racist stereotypes that may reinforce the belief that not all children can actually learn, we must simultaneously acknowledge Africans as the pioneers of mathematics (Akua, 2012; James, 1992; Williams, 1987). To address this focus of practice, I discuss the rationale about why this work is important, analyze the assets and challenges about conceptual mathematics curriculum currently used in the school, and explain why this research is important in the school and in urban schools in general.

Rationale

In the participatory action research project, I held a firm premise that conceptual mathematics is the gateway to higher education. Algebra and geometry courses are required for undergraduate four-year college entrance and are needed to ensure a better quality of life because higher paying jobs and professions require mathematics and technology skills (Moses, 2001). In fact, the technology industry is rapidly advancing, and the need for mathematics skills in the labor force has recently increased. As predicted by Moses, "by the year 2010, *all* jobs will require significant technical skills" (p. 9). Conceptual mathematics understanding is required for

higher-level math courses and careers. However, many students give up on dreams of attending four-year universities when they are not successful with completing challenging mathematics courses. The defeat begins in the formative upper elementary school years of mathematics when students fail to master mathematical concepts because teachers fail to teach conceptual mathematics (National Council of Teachers of Mathematics, 2014; Yurekli et al., 2020).

The teachers often are not to blame for not teaching conceptual mathematics because schools and districts purchase curriculum and prepackaged school reform remedies without proven success and do not provide the kind of professional learning that is necessary for shifting from teaching problem-solving and algorithms to engaging in mathematical discussions. For example, when we began teaching the Common Core grade level standards, the district purchased curricula, but those choices did not meet the needs of the required Common Core standards. As Spillane (2013) explains, "market supply is matched by market demand as eager consumers, practitioners, and policymakers seek solutions to ill-defined problems that fall under the umbrella of improving student performance on state-mandated tests" (p. 7). In mathematics instruction, the curriculum we used focuses on procedural lessons with few conceptual mathematics lessons.

Secondly, many teachers teach mathematics in the ways they learned, which in most cases were procedural problem-solving steps. Some teachers may omit teaching conceptual mathematics as they do not have the knowledge and skills to teach conceptual mathematics. According to the National Council of Teachers of Mathematics (2014), "researchers have consistently found that students living in poverty, whether urban or rural, as well as students who have struggled to learn mathematics, are more likely to have teachers who have weaker mathematics backgrounds…" (p. 61).

In addition to possibly having teachers with insufficient skills, several reasons, including psychological and political causes, prevent African American students from achieving mathematics. In several classrooms, African American students see themselves as less capable of learning mathematics and subsequently fail to apply themselves to learn math, often giving up trying to learn mathematics and accept being placed in lower-level math courses. According to McKenzie and Scheurich (2004), "…students come to see themselves as being less intelligent or as incapable of doing well in school. Teachers will give these students less rigorous curriculum, are held to lesser standards and oftentimes are placed in special education or lower-level classes" (p. 604). To interrupt the pattern of teaching less rigorous math, teachers need professional learning in order to use tools to unlock conceptual mathematics understanding at the elementary school level and build a foundation for higher-level mathematics.

Concurrently, teachers must believe that all students can learn. While teachers profess to believe in children, their actions do not always match their professed beliefs (Yurekli et al., 2020). According to Gutiérrez (2013), "That is the myth we have constructed: some people are good at mathematics and some are not; therefore, some people possess intelligence and some do not" (p. 10). Social stereotypes and negative prejudice lead to African American students experiencing micro-aggressions or being ignored, which increases student anxiety and reduces their ability to engage or concentrate (Steele, 2010). Teachers and school leaders must recognize the need to have a growth mindset about teaching mathematics and set students up for success by teaching mathematical concepts in the upper elementary school grades with high expectations (Dweck, 2007). The issue of whether students may possess a fixed or malleable mindset about their mathematical abilities is a reason for the study (Sun, 2018).

Thus, African American students do not see themselves as capable in mathematics, and

teachers often reinforce their beliefs. Teachers can begin by having African American students see themselves as being successful in mathematics. One possible strategy might be through teachers showing images of African American mathematicians and discussing African American scholars of mathematics. However, even further, teachers need to develop skills on asking probing questions and engaging students in productive struggle about mathematics concepts until they understand and learn the concepts. Teachers must engage students in academic discourse about conceptual mathematics and give them the opportunity to explain their problem-solving strategies. Next, I provide a diagnosis of the analysis of the assets and challenges of mathematics instruction at the school involved in this study.

Analysis of Assets and Challenges

To gather information from the teachers about the assets and challenges of mathematics instruction at my school, I engaged the third through fifth grade teachers in a conversation. First, I identify those assets and challenges about our mathematics instruction in relation to the micro (school), meso (district), and macro (state and national) levels of the FoP. Then I present a graphic representation of the assets and challenges.

Micro Assets and Challenges

At the micro level, we identified several assets. First, the mathematics instruction at the school identified the curriculum lesson design as an asset. Teachers stated that the curriculum design was consistent across each grade level. The teachers shared that as the students moved up the grade levels, they were familiar with the lesson design and knew certain expectations such as writing the daily learning objective at the start of each lesson followed by writing definitions of mathematics academic vocabulary. Secondly, across grade levels, student math books have similar graphic organizers for writing the problem of the day, learning objective, math

vocabulary, student guided practice, and independent practice. In addition, the teachers identified the consistent use of academic language across the grade levels. Finally, the district instructional coach is helpful to teachers. Twice a month, a district math coach demonstrates lessons in the classrooms. The coach may observe instruction, provide feedback, and facilitate professional development. Once per trimester, the coach leads data analysis sessions.

At the micro level, the teachers expressed challenges about pacing and coverage, student fluency with math facts, and the need for differentiation. Teachers stated that the mathematics curriculum pacing is too fast and do not allow time for re-engagement when students do not master the standards. The teachers expressed concern about covering standards and not teaching the standards. Secondly, several students in the upper elementary school grades do not have fluency with math facts. Teachers reported that the lessons move more slowly when third grade through fifth grade students have to count on their fingers to solve simple addition or multiplication problems. Because of the range of abilities in third-fifth grade, teachers had to differentiate for many levels of skill.

In particular, the teachers recognized that African American students continued to be the lowest performing sub-group on the district and state math assessments and explained their concerns in terms of how the students engaged or reacted. For example, they reported that African American students showed lack of engagement with math lessons, especially in academic discourse. When called on, several African American students generally showed lack of confidence in skill level and sit quietly. The teachers would often ask them to call on another student for help instead of asking students probing questions to help them solve the mathematics problems.

Meso Assets and Challenges

The meso level pertains to the district and supports from district departments. Our school, along with six of the fifty-five elementary schools, received approval for curriculum flexibility. The teachers expressed that the previous mathematics program adopted by the district was not supporting student growth for over six years, so some school leaders opted to use other programs. The teachers expressed that curriculum flexibility was a district or meso level asset. As stated, the teachers expressed appreciation for the district mathematics coach's support. The district provides our school with a mathematics coach who comes from the company that wrote the curriculum we use. The district has provided student consumable mathematics workbooks and homework books for each student at each grade level. The current mathematics program at our school is not the same program at all schools within the district.

The teachers identified several challenges at the meso level. They found a lack of lessons that use manipulatives to support conceptual mathematics understanding. Teachers must design lessons that use manipulatives. The teachers purchase or make supplemental materials for conceptual mathematics instruction, such as base ten blocks, and models of equivalent fractions. The final challenge named at the meso level by teachers is the quantity of district level assessments. Teachers expressed that there are too many assessments and that assessments take up instruction time. Next, we examined the assets and challenges from the macro level.

Macro Assets and Challenges

At the macro level, the teachers shared appreciation for the state's attempts to experiment and pilot different mathematics curricula and saw this action as an asset. Recently, the state gave districts more funding to adopt a mathematics curriculum program to support learning of the Common Core Standards. However, several publishers are vying for the professional

development contracts and trying to get their programs seen by teachers who are included in the curriculum adoption. High-stakes accountability tied to student performance has contributed to a vibrant market of prepackaged school reform remedies in American education (Spillane, 2013).

However, the teachers noted a challenge pertaining to the many mathematical standards; in fact, there are more standards than there are instructional days. In addition, some programs offered did not align with the state standardized test, which now requires that students explain their thinking. Teachers expressed that they cover the mathematical standards but are rushed to ensure the students master the concepts in the lessons. Teachers and staff note more funding for support staff, manipulatives, and alternative curriculum for students with learning disabilities.

The fishbone diagram (see Figure 1) summarizes the assets and challenges as by our teachers at the micro, meso and macro levels. As a result of identifying the assets and challenges, teachers found that there is a need for them to develop additional conceptual mathematics lessons that engage African American students. As Guajardo et al. (2016) remind us: "The people closest to the issues are best situated to discover answers to local concerns" (p. 25). Therefore, the focus of practice for this research project was developed - examine to what extent third through fifth grade teachers co-design and implement conceptual mathematics lessons that equitably engage African American students.

Significance: Practice, Policy, and Research

The participatory action research (PAR) study with the focus of practice (FoP) on conceptual mathematics is significant because 49% of students at the participating school are African American and are the lowest performing sub-group. Quality education is a critical civil v right because education opens the doors of opportunity, and mathematics instruction is necessary to a quality education (Moses, 2001). Conceptual mathematics lessons need to be taught and

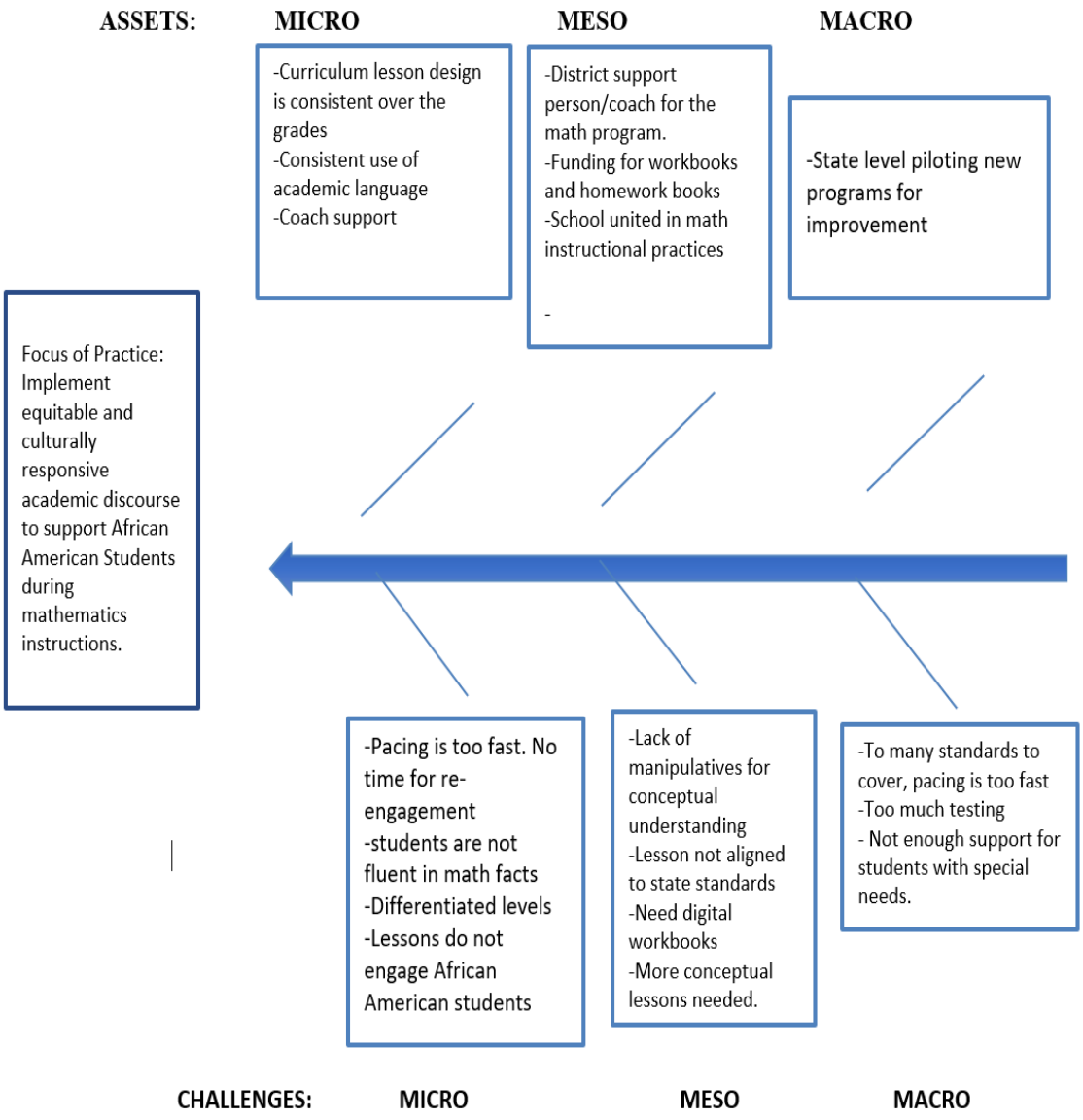


Figure 1. The fishbone diagram: An analysis of the assets and challenges of the FoP.

culturally responsive strategies for equitable engaging African American students must be developed.

Therefore, the focus of practice for this participatory action research project was to have third through fifth grade teachers implement equitable and culturally responsive academic discourse to support engagement for African American students. As the school administrator, I observed that conceptual mathematics instruction was limited. The curriculum that we use has one conceptual math lesson to every seven lessons on procedural math. In addition, teachers needed to learn culturally responsive practices that engage students with the use of manipulatives and participation in academic discourse through the understanding of grade level standards. When teachers engage students in academic discourse, all voices should be equitably included. Zwiers and Crawford (2011) state, “equity (in conversations) means providing underserved students extra experiences, resources, knowledge, skills, and language so they may gain equal access to future educational and professional opportunities" (p. 21). As this work unfolded, our evidence may influence the next mathematics curriculum adoption selected by our school and our district to include more conceptual mathematics lessons with manipulatives and protocols for student academic discourse (Fullan, 2000).

The participatory action research (PAR) is significant to practice in two essential ways – academic and equitable access. Teachers improved their practices by learning how to implement culturally responsive academic discourse while equitably engaging all students. Our work may influence all teachers in our school and be a guidepost for other schools engaging in a similar process because the content of the lesson – math concepts – can be a tool of equitable academic discourse and student engagement. Students learn best when they are able to articulate meaning (Hammond, 2015). As Zwiers and Crawford (2011) explain,

> the use of language, whether used by a pair of students in the classroom or at international peace summits, is a powerful tool. People use language to influence others, establish dominance, and defend their beliefs and rights. We want students to have and use the tools of language to even the playing fields-to share their ideas, defend their opinions, and change the many unjust cycles that are perpetuated by current policies and practices. (p. 21)

Therefore, as we connected the PAR to equity for equitable and culturally responsive academic discourse, and, if we can achieve this, we hoped to influence policy and research efforts.

In terms of policy, the PAR could be significant to local and state policy because state tests require students to explain their thinking about conceptual mathematics understanding. As teachers planned to implement culturally responsive strategies and engaged students in academic discourse, there should be improvement in this area. As districts and schools purchase new mathematics curricula every few years, ensuring that conceptual mathematical lessons are included in the curriculum should be required. Textbook selection must include quality conceptual mathematics lessons with culturally responsive engagement strategies and guide teachers on how to use manipulatives to teach conceptual mathematics understanding.

Finally, in terms of research, this is a small study in one school, and the results may not be generalizable, but the process can be replicated. Engaging in small studies in the local context is the heart and soul of activist research, which I discuss in more detail in Chapter 3 (Hale, 2017). By addressing a macro social issues in a micro context, we provided avenues for other school leaders and teachers to engage in action research studies to improve the teaching and learning in their schools.

Connection to Equity

Being an equity warrior as a school leader takes courage (Leverett, 2002). As a leader, I often have to justify why it is necessary to have extra support and programs to ensure equity for underserved populations. Data are helpful in supporting an equity stance. Clear evidence demonstrates that historical practices of injustice, racism, stereotypes, and prejudice prevent African American students from gaining access to the knowledge needed to succeed in school (Kendi, 2019). According to Eubanks (1997), "...children in urban type schools are viewed as 'needing more structure' because they are 'from disadvantaged conditions' or 'from single parent families' or 'working families' or 'more dangerous" (p. 156). However, that belief ignores the promise of tapping the students' potential. In terms of mathematics achievement, the data indicate that African American students suffer from low achievement rates that lead to low high school graduation rates, low college admission rates, high college drop-out rates, and lack of preparation for professional opportunities (Kendi, 2019; Moses, 2001; Steele, 2010). Two equity frameworks provided support for the research. First, in the psychological frame, I discuss how stereotypes and self- images affect the math identity of students. Secondly, I discuss the political frame and the power dynamics that influence African American student engagement in academic discourse during mathematical instruction.

Psychological Frame

Racial prejudices and stereotypes are ingrained in each of us. According to Wilkerson (2020), *"*what we actually 'see'…are the learned social meanings, the stereotypes, that have been linked to those physical features by the ideology of race and the historical legacy it has left us" (p. 67). As I observed teachers during mathematics instruction, the teachers did not ask many probing questions of African American students. If a teacher called on a student, the teacher used

limited wait time to expect a response. Quickly, students were asked to call on another student for help, and the other student answered the problem.

As a result, I could observe that the children were not developing positive math identities. Instead, an equity goal of this study was to attend to the self-images that many African American students have of themselves in mathematics. In our society, there is an unspoken generalization that mathematics is for White and Asian people and that Black people are not good at math (Steele, 2010). That needs to change so that students develop a malleable, rather than fixed, mindset about their abilities and believe they can think about and talk about mathematics.

Political Frame

According to Mills (1997), "white supremacy is the unnamed political system that has made the modern world what it is today" (p. 1). That system influences the power dynamics in classrooms. As I observed teachers during mathematics instruction and noticed a lack of engagement from African American students, they were called on to read a procedural problem-solving step to get the correct answer. The teachers did not attempt to fully engage the African American students in academic discourse, sending an unspoken message that students are not expected to learn and will not be held accountable (Darling-Hammond, 1996).

Thus, academic discourse is important in conceptual math understanding so that students have the opportunity to express their thinking and deepen their mathematics understanding. Teachers need to know how to fully engage students in equitable student participation. Gutierrez (2013) shares a synopsis of effective school mathematics instruction: "As might be expected, their teachers presented engaging lessons where students worked in groups, used rigorous texts and appropriate technology, worked in Spanish and English, and had opportunities to do projects or problems that reflected their lives" (p. 8). Students need to be given time to learn the

mathematical concepts and engage in academic discourse with other students in the learning process, which, of course, presents a dilemma for us that is part of the discourse about who decides what and how to teach. As Freire (1970) says, “The students- no longer docile listeners- are now critical co-investigators in dialogue with the teacher. The teacher presents the material to the students for their consideration and re-considers her earlier considerations as the students express their own" (p. 18). We questioned the school's adopted curriculum (Darling-Hammond, 1997) and decided how to integrate conceptual mathematics lessons that require academic discourse. As Martin (2007) argues, teachers who support African American learners and learning should be persons who are:

> (a) developing deep understanding of the social realities experienced by these students, (b) taking seriously one’s role in helping to shape the racial, academic, and mathematics identities of African American learners, (c) conceptualizing mathematics not just as a school subject but as a means to empower African American students to address their social realities, and (d) becoming agents of change who challenge research and policy perspectives that construct African American children as less than ideal learners and in need of being saved or rescued from their blackness. Teachers who are unable, or unwilling, to develop in these ways are not qualified to teach African American students no matter how much mathematics they know. (p. 25)

As a school leader, I guided the school team to examine the power dynamics and concentrate on equity goals. Rigby and Tredway (2015) said, “without a clear and present equity frame, principals can easily get sidetracked by a changing district agenda, neglect the need for school context to be the driver of decisions, and lose touch with his or her principles” (p. 330).

As the teacher group stayed connected to these goals, teachers offered more opportunities for African American students solving conceptual mathematical problems.

Participatory Action Research Design

The participatory action research (PAR) design required the lead researcher to actively participate in the study. As the lead researcher, I invited a group of five teachers to increase their knowledge and skills as we participated in this PAR study. The group is a co-practitioner researcher (CPR) group because they used the evidence I analyzed to collectively make decisions about next steps. In this study, I used data from observations, post-observation conferences, and documents from meetings (Creswell & Creswell, 2018). In addition, I used CLE protocols and used the evidence from those artifacts. Finally, I wrote reflective memos. In this PAR, we engaged in three iterative cycles of inquiry in which we examined the questions.

Purpose Statement and Research Questions

The purpose of this participatory action research project was to work with third-fifth grade teachers to implement equitable and culturally responsive academic discourse to support African American students. The CPR group used the professional learning community (PLC) structure to examine the evidence I analyzed to make decisions about next steps (Collins & Stevens (1983) . In the meetings, we planned culturally responsive strategies that included equitable protocols for academic discourse to ensure African Americans had an equitable voice during discussions. As the instructional leader, I observed the lessons that the teachers implemented and analyze the process of implementing culturally responsive practices during mathematics lessons.

Research Questions

The overarching research question is: *How can third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction?* The research sub-questions:

1. To what extent do teachers effectively plan to use culturally responsive academic discourse routines during mathematics instruction?
2. To what extent do teachers effectively implement culturally responsive academic discourse routines during mathematics instruction?
3. To what extent did observations and post-observations support teachers to shift their practices to be equitable and culturally responsive?
4. How does the process of engaging African American students in equitable and culturally responsive academic discourse during mathematics instruction support my growth and development as an instructional leader?

The theory of action for this study: *If teachers effectively implement academic discourse routines in conceptual mathematics lessons, then teachers will equitably engage African American students.*

PAR Activities and Cycles of Inquiry

In Table 1, I display the proposed PAR activities and cycles of inquiry. In Chapter 3, I examine the cycle of inquiry with specific data that I will collect, code, and analyze. Evidence from each activity will inform our next steps in each cycle.

Engaging in PAR

I fully engaged in the PAR by grounding the work in two essential areas: improvement science and community learning exchanges (Bryk et al., 2015; Guajardo et al., 2016). In

Table 1

Research Cycles of Inquiry

Research Cycle	Activities
PAR Pre-Cycle Spring 2022	• Invite CPR participants to begin CPR meetings • Establish equitable protocols for questioning and calling on • Facilitate professional development on conceptual mathematics and culturally responsive practices • Facilitate a CLE
PAR Cycle One Fall 2022	• Facilitate professional development on culturally responsive practices • Observe classrooms • Facilitate post-observation conversations • Facilitate CPR meetings • Write reflective memos and field notes • Conduct member checks • Facilitate a CLE
PAR Cycle Two Spring 2023	• Plan lessons using culturally responsive routines • Observe classrooms • Facilitate post-observation conversations • Facilitate CPR meetings • Facilitate a CLE • Write reflective memos and field notes • Conduct member checks

addition, action and activist research inform this study (Hale, 2008; Hale, 2017; hunter et al., 2013).

Improvement Sciences Principles and Processes

According to Bryk (2015), improvement science (IS) principles represent the foundational elements for improvement science. As the CPR group meets to make improvements, the IS principles will drive the work:

- Make the work problem-specific and user- centered (p. 12)
- Focus on variation in performance (p. 13)
- See the system that produces the current outcomes (p.14)
- We cannot improve at scale what we cannot measure (p.15)
- Accelerate learning through networked communities (p 17)

Using the Plan, Do, Study, Act (PDSA) cycle of inquiry, teachers will co-plan lessons, implement the lessons, study data of the effectiveness of the lessons, and determine the next action. The participants will make the work problem specific and user-centered by designing and implementing lessons focused on conceptual mathematics to support equitable engagement for African American students.

Community Learning Exchange (CLE) Axioms and Protocols

In addition to the improvement science process, we relied on the community learning exchange (CLE) axioms and processes that are essential to the PAR study. The five axioms guided the CPR group giving all participants equitable access to engage in conversation (see Table 2). The CPR group engaged in the CLE procedures as they analyzed their work of co-designing and implementing conceptual mathematics lessons that engage African American students. As a school leader, remaining focused on the axiom that learning and leadership are

Table 2

Community Learning Exchange Axioms

Number	Axiom
1	Learning and leadership are dynamic social processes.
2	Conversations are critical and central pedagogical processes.
3	The people closest to the issues are best situated to discover answers to local concerns.
4	Crossing boundaries enriches development and the educational processes.
5	Hope and change are built on the assets of dreams of locals and their communities.

dynamic social processes is important. (Guajardo et at., 2016). Finally, as a school community, we established and reinforced a growth mindset that built on our assets and made the necessary changes for student improvement.

In summary, I invited teachers to join the CPR group to improve our capacity to understand conceptual mathematics and design and implement lessons. I collected and analyzed data from classroom observations, post-observation conversations, field notes, and reflective memos to engage participants in conversations about practice. Based on our collective analysis, we made decisions about next steps.

Study Considerations: Limitations, Validity, and Confidentiality and Ethics

I was the site administrator and the lead researcher for the duration of the research. More details of the limitations, validity, and confidentiality and ethics are in the research design in Chapter 3. The consent of all participants were given without fear of pressure of obligation. I made it clear that participants could withdraw their consent at any time without fear of repercussions.

Limitations

Two limitations of this qualitative research were my role as the school principal and the size of the study. As the site leader, my role as supervisor could have been a limiting factor as I evaluated teachers. Therefore, I took precautions to separate the observations in this study from the teacher evaluation process. Secondly, the CPR group size (n=5 teachers) was a limitation. A small group of teachers made up the study group, and the findings were primarily pertinent to our school environment and may not be generalizable to other settings. While we have a small number of people, I produced an in-depth understanding of the information obtained from an analysis of the focus of practice by using multiple sources of data and

triangulating these data to decide on findings (Quierós, 2017). The process of working with small groups of teachers is transferable to other school settings.

Validity

Issues of credibility (internal validity), transferability (external validity), dependability (reliability), confirmability (objectivity), and construct validity are addressed in this study (Guba & Lincoln, 2000). The study's construct validity and credibility are addressed by the multiple sources of evidence collected. I used reflective memos and member checks to triangulate the evidence. Such a design assures that the inquiries reflected the respondents' views and disengaged the research from any bias (Guba & Lincoln, 2000).

Confidentiality and Ethics

The security of the data collected and the confidentiality of the participants were and remain of the utmost importance. I used pseudonyms for the participants in the study. Participants completed the required permission forms approved by the Institutional Review Board at East Carolina University (ECU IRB, see Appendix A). I kept the transcription of field notes and documents collected in a secure, locked file cabinet; all computed data collection forms were kept in a password-protected database; and data and copies of reports were shared with the CPR group for the sake of disclosure, improvement, and reflection. All documents will be destroyed after three years. For the researcher to conduct the study, the school district's Office of Research granted approval (see Appendix C).

Summary

In Chapter 1, I introduced the focus of practice (FoP) of this participatory action research that examines how third-fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction. In examining the focus of practice for the project, I explained the rationale and significance for this

study. I presented the research questions and the research processes I used in this qualitative participatory action research study.

As we advanced in this participatory action research study, Chapters 2-7 provide specific information about the process. The upcoming chapters focus on a literature review, methodology, context, and the PAR Pre-Cycle, and PAR Cycles One and Two. The research concluded with a summary of findings and a discussion about the overall process.

CHAPTER 2: LITERATURE REVIEW

In the literature review, I focused on the research that supports how we addressed the focus of practice: engaging third-fifth grade teachers in professional learning to implement equitable and culturally responsive academic discourse during mathematics to support African American students. The three major areas of this literature review are communities of practice, equitable academic discourse, and conceptual mathematics and rigorous mathematical tasks. First, I provide an analysis of sources that discuss communities of practice including adult learning theory and instructional leadership. Secondly, I reviewed research evidence about culturally and linguistically responsive practices of equitable academic discourse in regard to teaching and learning, and equitable protocols. Finally, I present a literature overview of understanding conceptual mathematics with rigorous mathematical tasks (see Figure 2 for a graphic representation of the literature review).

Communities of Practice

Collaboration is a critical competency for achieving and sustaining high performance (Kouzes & Posner, 2007). Working in isolation is not beneficial and does not lead to substantial success of an organization (DuFour et al., 2016). Collaborative practice is especially true in the field of education. As a result of participation in a community of practice (COP), teachers learn the most when they collaborate on topics of teaching and research capacities, personal professional learning, advocacy, and topics about which they genuinely cared (Lave & Wegner, 1991; Patton & Parker, 2017). As the CoP literature tells us, the community of practice is a place for participants to be members of a social community in which they do learn and operate as individuals, but not solely. Because they experiment with new ideas and then co-construct

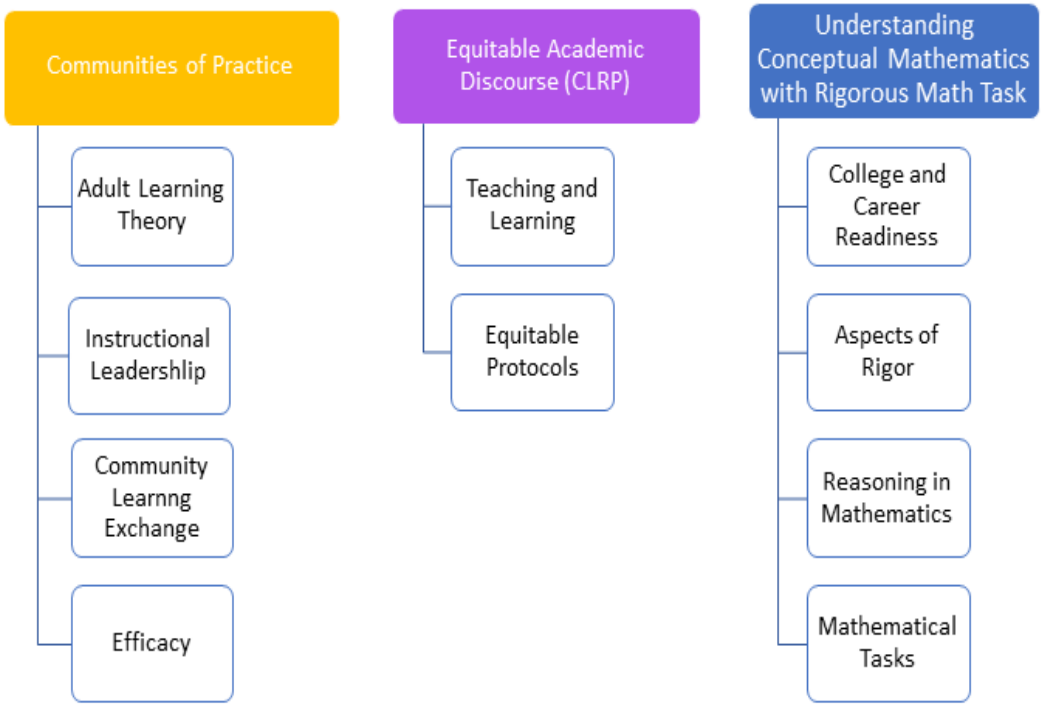


Figure 2. Literature review topics and sub-topics.

meaning, the participants are fully situated in the learning context and derive benefit in the form of peripheral situated learning as members of a group.

> Learning involves the whole person; it implies not only a relation to specific activities, but a relation to social communities – it implies becoming a full participant, a member [who engages] in new activities and performs new tasks and functions to gain new understandings…Viewing learning as legitimate peripheral participation means learning is not only a condition of membership but is itself an evolving form of membership. (Lave & Wegner, 1991, p. 53).

In the process, the person changes and grows, and as Dewey (1938) says, each experience in the group influences future experiences and sets up conditions for individual and collective growth.

The literature reveals that using communities of practice (CoP) as a foundational theory and process is a critical process for educational teams (Lave, 1991). The process supports participants to tap into every available source of information and investigate problems and situations together (Kouzes & Posner, 2007). First, I review research about adult learning theory that includes a review of teachers as learners, professional learning communities as communities of practice, and community learning exchanges as a process to effectively shape and support a CoP. Secondly, I review research about instructional leadership with information about data driven instruction, professional development, observation and coaching. Lastly, I discuss the importance of efficacy.

Adult Learning Theory

Adult learning theory or andragogy is the study of how adults learn and identify the learning styles that suit them best. According to Malcolm Knowles (1992), when adults learn, they need a connection to their backgrounds, needs, interests, problems, and concerns. By taking

initiative and seeing the learning in the context of their life situations, adults internalize the content they are learning more quickly, retain information more permanently, and apply what they are learning more confidently (Knowles, 1992). In addition, adults need to be engaged in the learning process. When people have the opportunity to engage, they learn best. As active participants engage in a process of inquiry, they feel valued. As adults learn together in the communities of practice, they learn to work together in collaborative teams. At the heart of collaborative teamwork is trust (Lencioni & Stransky, 2002). Building trusting relationships and building them on safe ground is highly important. In relation to adult learning theory, adults want to work with persons they trust so that they can learn more effectively because they can be open (Patton & Parker, 2017). When we trust people, not only do we feel free to offer our opinions and suggestions, we listen to the opinions of others and accept their influence (Kouzes & Posner, 2007). Next, I connect teachers as learners to adult learning theory.

Teachers as Learners

Like most adults, teachers learn best by doing. They need adult learning experiences that represent the key tenets of strong learning experiences: interaction and continuity (Dewey, 1938). More than 2,500 years ago according to DuFour (2016), Confucius observed, "I hear and I forget. I see and I remember. I do and I understand" (p. 9). Although teachers spend four to five years taking classes, getting degrees, and credentials, they agree that they learn more about teaching during their first year of on the job experience than all the years of preparation for the profession (Martinez et al., 2016). As they are teaching, having time for ongoing practical training is essential, and "principals should support opportunities for teachers to learn collaboratively with their colleagues and provide ongoing, job-embedded professional learning for educators that deepens their understanding and practice of teaching for deeper learning"

(DuFour et al., 2016, p. 1). Based on this information, teachers need time to develop as curious learners, work collaboratively, and make connections with resources (Darling-Hammond, 1999). As teachers learn in communities of practice, they learn best when they have the opportunity to engage in meaningful, purposeful authentic tasks that are relevant to their teaching. They prefer experiences for immediate application to teaching their students (Patton & Parker, 2017). As teachers learn in communities of practice, they should learn from on-going dialogue, taking time for self and group reflection, and engaging in collective research. As teachers learn together, they should engage in cycles of inquiry during professional learning communities as present in the next section.

Professional Learning Communities

In schools, a professional learning community (PLC) is a structure that engages teachers in cycles of inquiry about student learning (DuFour et al., 2016; Little, 2006). Being part of a community, network, or team offers one of the most powerful modes of professional development (MacPhail et al., 2014; Patton & Parker, 2017), suggesting that learning between members is even more powerful than individual learning (Collins, 2006). Together, teachers plan standards-based lessons and formative assessments to see if students learned what they were taught. In the process, the teachers take responsibility for student learning by looking at assessment evidence, and making plans for re-teaching, providing intervention or challenge lessons (DuFour et al., 2005). Teachers share best practices, engagement strategies, and more. As teachers work collaboratively to clarify the essential learning, write common assessments, and jointly analyze the results, they build collective knowledge and capacity, the essence of a community of practice (Lave & Wegner, 1991). They learn that working together gives them

access to more suggestions for students' improvement (Larson et al., 2012). As stated by DuFour (2016),

> PLC members work together to clarify exactly what each student must learn, monitor each student's learning on a timely basis, provide systematic interventions that ensure students receive additional time and support for learning when they struggle, and extend their learning when students have already mastered the intended outcomes. (p. 11)

In a professional learning community, teachers are not just meeting to discuss readings or engage in weekly team meetings. The teachers work collaboratively to focus on learning and are results orientated. They must follow the cycle of inquiry protocol and focus on student learning at high levels.

For the professional learning community process to be successful, the school must make time for PLCs in the organizational practice. The school leaders communicate the clear purpose, process, outcome and model of the PLC structure. Time needs to be given for the PLC process with resource allocations aimed at achieving the goal of the PLC as a priority. Staff members should hold each other accountable because they value the process as it leads to high outcomes for students (DuFour et al., 2016). As an organization, teachers and staff need to view the PLC process as one that empowers educators to make important decisions and encourages their input about student learning. The PLC structure should be both loose and tight as its structure needs to be clear but allows for teacher creativity. Similar to the professional learning community is another form of a community of practice, the network improvement community as shared in the next section.

Instructional Leadership

Instructional leaders nurture a culture of risk-taking and learning thereby creating opportunities for staff to identify areas of needed improvement (Bambrick-Santoyo, 2018). As I lead the school team to make necessary improvements in conceptual mathematics instruction, I must make it a priority to focus on the instructional needs of the school (Ferguson, 2007). However, principals do not spend sufficient time on instructional roles – 12% average for high schools to 17% of their time for elementary principals (Grissom et al., 2013). Far too often principals find themselves stuck in their offices completing compliance reports, attending meetings about facilities or non-instructional topics, and addressing a host of other concerns other than instruction. Many school leaders have come to depend on instructional coaches to support and lead teachers. However, schools that have made the most effective academic growth are schools where the principal has an active role engaged in instructional leadership (Leithwood, 2021).

Guiding and inspiring others to journey willingly toward an identified target is a part of being an instructional leader. Supporting teachers to make meaningful changes in the direction, beliefs, values, practices and skills is what good school leaders can achieve (Buffam et al., 2008). As with any team, the foundation of an instructional leader and leadership teams is built on trust (Bryk & Schneider, 2002; Lencioni & Stransky, 2002; Tschannen-Moran et al., 2014). As instructional leaders build instructional leadership school teams, they must focus on data driven instruction, professional development and observation, feedback and coaching (Bambrick-Santoyo, 2018). In a collaborative culture, instructional leaders must both lead and serve. Our mantra must be ‘how can I help?’ When we lead as a facilitator, we help individuals co-create the answers rather than provide the answers. Though we may feel leaders have the answers, we

must resist the urge to provide answers (Kouzes & Posner, 2007). We must allow for deep exploration and creative responses as we engage our staff in inquiry. We push up our sleeves and join the conversation (Buffam et al., 2008). Knowing what direction to lead your team should be based on the needs of the students. Next, I highlight the importance of data-driven instruction.

Data-Driven Instruction

Data-driven instruction must be the priority for school improvement. In fact, according to Bambrick-Santoyo (2018), "schools that had not mastered data-driven instruction or student culture found it impossible to significantly boost student achievement, despite spending significant time on the other levers" (p. 19). In order for teachers to know the skill levels and gaps in what students have learned, assessments are regularly given. Assessment that can be disaggregated by race and gender help inform teachers of sub groups that may need more support. (Darling-Hammond, 1997). School leaders must ensure teachers assess students and review the data frequently. Assessments can be formative data, which is used to inform instruction. Formative assessments give the teachers data about what the students have or have yet learned (Marzano, 2006). For example, during mathematics instruction, formative assessments such as exit tickets, quizzes or at the end of a lesson, a chapter or a unit, can be given to collect data about student learning. The data should be used to plan reteach lessons, challenge lessons or intervention. Summative data are used to evaluate instruction (Venables, 2014). Summative assessments are usually given at the end of learning, such as at the end of a course. According to Marzano (2006), "...250 students [show] that formative assessments as opposed to summative ones, produce the more powerful effect on student learning" (p. 9). The frequency of formative assessments is related to student academic performance. According to Marzano, in a meta-analysis …from twenty-nine studies, he found that academic performance

growth was associated with the number of formative assessments over fifteen weeks (see Table 3). As teachers use formal and informal formative assessments, feedback data with suggestions for improvement should be frequent as well. School leaders must make time for teachers to create or select formative assessments that matter and analyze the results data; termed pragmatic assessments in math, the frequency of this kind of data supports teachers to assess iterative students learning and make immediate adjustments (Cobb et al., 2011). During PLCs, members can engage in data conferences to review evidence and then design instructional plans to support student needs. The data helps teachers reflect on their practice, which leads to student improvement (Bambrick-Santoyo, 2018). Instructional leaders should review the data as well and provide support to teachers in areas needing improvement. The support can be shared during professional development sessions in which the school leader organizes to attend to the needs of the teaching staff, based on observations and conversations of and with teachers (Grissom et al., 2021).

Professional Development

Teachers need time for collaborative professional development focused on learning, teaching, and assessing mathematics (Larson et al., 2012) because more students fail in mathematics than any other subject (Singham, 2005). In addition, they need to time to learn and plan to practice culturally responsive lessons. Although instructional leaders can plan engaging professional development presentations on content and teaching skills, job-embedded professional learning, focused on routines and practices used by collaborative teams to analyze student-learning results, should be a strategic part of ongoing professional development. The simplistic make- and take- it workshop models of professional development for math instruction

Table 3

Formative Assessments Support Teachers and Students

Number of Assessments	Effect Size	Percentile-Point Gain
1	.34	13.5
5	.53	20.0
10	.60	22.5
20	.71	26.0
30	.80	29.0

Note. (Marzano et al., 2006).

no longer meet the needs of the common core standards that students need to master (Larson et al., 2012). Instead, instructional leaders must give teachers time to work in communities of practice or PLCs as they link mathematics instructional planning to useful assessments. Many schools have shifted to brief professional development sessions that lead straight into PLCs or have replaced professional development into PLC structures (Buffam et al., 2008). During reflection on practice and dialogue with colleagues, teachers identify the instructional shifts needed in their practice (Militello et al., 2010). If teachers work alone, the inconsistencies teachers develop in their professional development practice are often random and in isolation from other teachers which can create great inequities in students' mathematics instructional and assessment learning experience that ultimately and significantly contribute to the year by year achievement gap (Patton & Parker, 2017).

The need to support the academic mathematical growth of African American students is paramount. To support teacher learning, instructional leaders are responsible for allocating time for professional development in culturally responsive practices in communities of practice as well (Khalifa, 2018). Radd et al. (2021) designate five practices in which school leaders should engage: prioritize equity leadership, systematically prepare to have equity conversations, develop equity leadership teams, and build equity-focused systems to sustain equity – all practices that other researchers support (Galloway & Ishimaru, 2017; Ishimaru & Galloway, 2014; Ishimaru & Galloway, 2021; Khalifa et al., 2016).

Overall, successful professional development is collaborative and includes time for teachers to learn and plan in collaborative groups. As teachers plan and agree on the implementation of practices to improve learning, instructional leaders attending to observation,

coaching, and effective conversations as well as useful professional development are essential to support teacher growth.

Observation and Coaching

Building and implementing frequent observation and conversation cycle that support an equity-focused system is a key step. A good habit for school leaders and leadership teams is to observe and have frequent conversations with teachers (Bambrick-Santoyo, 2018). According to Schmoker (2011), "[i]f we want better schools, we have to monitor implementation of our highest priorities" (p. 18). Instructional leaders need to know that teachers do not only hear sound advice, but that they actually practice what needs to improve (Militello et al., 2010). Frequency of observation and feedback are the keys to building strong teachers. Coaching teachers and not simply evaluating them is the purpose of observation and feedback; therefore, once or twice a year observations are not conducive to teacher growth (Bambrick-Santoyo, 2018).

Instructional leaders who coach have to be prepared to teach and show their experience, wisdom, and expertise with teaching strategies (Dewey, 1938). Coaching as opposed to evaluation can make a significant difference in the development of teachers (Aguilar, 2016). Coaching based on observation data helps teachers know what action steps should be taken for improving their practice (Tredway et al., 2021; Tredway & Militello, In press). For example, if the school goal is to engage students in academic discourse during mathematics instruction by asking probing questions, then the coach can collect data during observations, review the data during a conversation with the teacher and guide the teacher to decide on next steps for improvement in that area. The coach can model the action step to give the teacher a clear understanding of what is expected (Tredway et al., 2019; Tredway et al., 2021). However,

coaching cannot take place unless there is a trusting relationship so that the teacher feels safe enough to open up to learn, to grow, and to change their practice (Lavinia & Moskowitz, 2012). Instructional leaders should guide teachers in the process of thinking about and naming their areas for needed improvement as this metacognition process will more likely help them internalize the feedback and support from the coaching of the instructional leader (Tredway et al., 2020).

The Community Learning Exchange

A community learning exchange (CLE) is the opportunity for school leaders, teachers, staff, parents, community members, elders, and youth to come together to discuss and learn and share suggestions for making improvements (Guajardo et al., 2016). As dilemmas are examined, much can be learned from participants in the collaborative community learning exchange (Mørck, 2010). As a society, we suffer if we are silent about the lack of growth, development, racism and practices that do not support our schools (Tatum, 1997). When communities can connect and share experiences, we validate each other and find the courage to make effective changes. Working together to realize common interests, however, is not always a harmonious process. There is the potential for conflicts, struggles, disagreements, and clashes of interests to arise (Holzkamp-Osterkamp, 1991), and usually compromises are necessary. Participants should engage in mutual exchanges and learn from various positions and perspectives, widening the critical consciousness of all the contributors (Morck, 2010). The goal is for all participants to feel successful in their contribution to the community.

Efficacy: Growth Mindset for Teachers and Students

The Efficacy Institute (2016) is a nonprofit committed to developing high standards for children by building the capacity of adults to address this objective: “to build belief that virtually

all children can get smart" (https://www.efficacy.org/about-us). Their goal is to eradicate the myth that poor children, primarily children of color, are incapable of learning at high levels. With attention to efficacy, teachers can develop a growth mind-set about how all students can learn no matter their circumstance (Howard, 2016). When students believe that teachers see them as learners, they develop positive relationships with that teacher and then can learn more from them (Kervin, 2016). Teacher-student relationships require effective communication, fair expectations, and accountability. Teachers should show their pride and belief in students by displaying their work, giving them praise and feedback and speaking about their growth. Overall, efficacy is a mindset of teachers that can positively impact student learning in ways such as communities of practice (Brown, 2003).

A cornerstone of the PAR project is relying on collaboration as a critical component for achieving and sustaining high academic performance. As adults understand that they learn best in communities of practice or professional learning communities and by engaging in community learning exchanges, school improvements can be made by sharing ideas and building a trusting collaborative community. Instructional leaders support the communities of practice by prioritizing time for professional development in professional learning communities and by supporting and coaching teachers to implement the necessary action steps (Aguilar, 2016). The overall goal is to find solutions to identify practices, like efficacy, that have the highest yield for student achievement (Hargreaves & Fullan, 2012).

Culturally Responsive and Equitable Academic Discourse: Engaging African American Students

Engaging all students in equitable academic discourse during mathematics instruction is a critical process for developing students' abilities in problem solving and critical thinking skills.

As Hammond (2015) says, “the brain is a social organ, meaning it works best when it has the opportunity to connect and interact with others” (p. 44). When students use oral language, they develop the foundation to build literacy and learning throughout their lives (Zwiers & Crawford, 2011). As students discuss problem-solving strategies, they develop critical thinking and reasoning skills by speaking, listening, catching errors and considering new problem-solving strategies (Stein & Smith, 2018). A key factor in student engagement is the relationship they have with teachers so that the teacher is able to know the student, and the student feels safe in contributing to the classroom dialogue. Building trusting relationships is especially important for teachers working with African American because of the presence of historical biases and the possible prior negative experiences the students may have had in school. Teachers must be competent in the content knowledge of conceptual mathematics and build strong lessons with effective questioning strategies. Finally, I analyze how teachers can use equity protocols as they differentiate academic discourse based on the diverse needs of students. Teachers must engage all students in academic discourse with equitable protocols and encourage them to lift their voices as they share how they solve problems. As teachers guide students to have discourse about solving rigorous mathematics problems, teachers must use teaching and learning practices to support student development of critical thinking and reasoning skills, which leads to the topic of teaching and learning.

Teaching and Learning

A set of skills related to teaching and learning are essential for engaging students in equitable academic discourse about conceptual mathematics (NCTM, 2014). Teachers must be knowledgeable and competent in the grade level content standards and design lesson plans that include strategies for participation in academic discourse. In addition, they should use

questioning skills to lead discourse and to assess student learning. Before any of these aspects of teaching and learning begin, teachers have to build trusting relationships.

Building Trusting Relationships

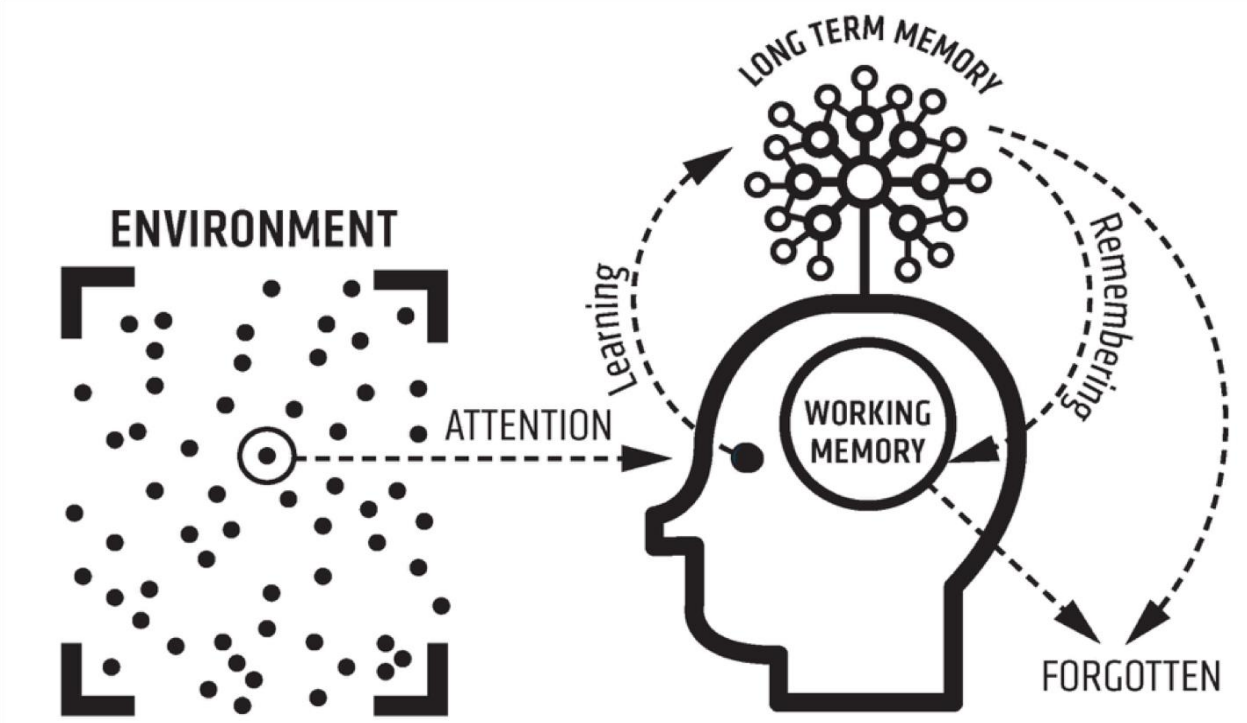
For teachers to value the student voice, they must learn the importance of engaging all students in academic discourse with equitable access built on trusting relationships. Historically, African American students have been denied access to such conversations. Systemic practices from the dehumanizing effects of slavery linger in our African American students today as they often feel unworthy or uninvited into classroom discuss. “Minoritized students were accustomed to having their voices and identities silenced in traditional schools" (Khalifa, 2018, p. 113). Muhammad (2020) said, “Black people created their own spaces because they were not invited or allowed to speak or participate in White-run literary organizations” (p. 9).

As our society continues to heal and disrupt the prejudices associated with the racial stereotypes and mindsets, teachers must acknowledge their implicit cultural and racial bias as they engage students in academic discourse. Reinholz et al. (2019) quoted Greenwald and Krieger (2006) in stating that “implicit biases are ‘discriminatory biases based on implicit attitudes or implicit stereo-types’ which subtly shape one’s thoughts and actions” (p. 259). Classroom teachers have the power to affect whether students feel comfortable to engage in learning as they express subtle biases.

> Biases also often lead to microaggressions, which are ‘brief, everyday exchanges that send denigrating messages to people [who are minoritized] because they belong to a [minoritized] group’. Microaggressions typically manifest through brief exchanges, delivered through dismissive looks, gestures, tones, or comments. (Reinholz et al., 2019, p. 261)

As teachers learn to recognize and address their biases, they can become more comfortable with having conversations about race and culture. They can learn how to address prejudiced remarks and racist practices and become aware of interactions – among students and in teacher to student interactions -- that can make some students feel devalued and unsafe.

The teachers' role is to set up classroom communities with risk-free learning environments for safe academic discourse (Parrish, 2010). According to Hammond (2015), "when anyone experiences others in an environment like a classroom that is inattentive or hostile, the body picks up that information through the autonomic nervous system and sends it up to the RAS and amygdala" (p. 45). When people are fearful and do not feel safe they often freeze and learning cannot take place. Instead, students need to be comfortable in offering responses for discussion, questioning themselves and their peers, making mistakes, and investigating new strategies. The classroom should be a place where students feel they can freely express their ideas because they trust the teachers to keep the environment safe and free of harmful judgements. According to Nachmanovitch (1990), "in a real classroom, whether kindergarten, graduate school, or the school of life, there are live people with personal needs and knowledge" (p. 20). As teachers learn about the students' culture, background, and skills, teachers then plan for instruction based on student assets and needs. As Hammond (2015) suggests, if the environment is safe and welcoming, students can attend fully and then proceed to engage in the learning process with the intention that there are opportunities to practice, remember, and store learning knowledge and skills in long term memory. When learning is interrupted at the first stage of information processing – attention to stimuli, then learning is already jeopardized. Once trusting relationships are built in a safe environment, then other stages of learning are more likely to occur (see Figure 3).



Note. Adapted (Hammond, 2015).

Figure 3. Information processing is most successful in a safe learning environment.

Content Competency

Teacher competence, especially at elementary level in which teachers are not necessarily content experts in math, includes fully engaging in math problems by having discussions about them with teaching peers, co-planning conceptual math lessons, and having sufficient meeting time to plan and discuss teaching practices. As teachers plan for engaging academic discourse in conceptual mathematics instruction, teachers need a competent level of understanding of the subject. According to the National Council of Teachers of Mathematics (2014), "the teaching of mathematics is complex. It requires teachers to have a deep understanding of the mathematical knowledge that they are expected to teach" (p. 7). Teaching mathematics requires a clear view of how students learn mathematics and progress across grades (Ball et al., 2008; Daro et al., 2011; Sztajn et al. 2012). Thus, teachers need to dissect mathematical problems and put them back together so they can support student learning (Moses, 2001).

Once teachers are feeling competent, they should know how to engage students in instructional practices that support academic discourse while maintaining high expectations and a growth mindset. Discussions afford opportunities for students to do such things as explain and justify solution strategies, pose questions, and articulate connections between ideas (Zwiers & Crawford, 2011). In other words, teachers must know how to afford opportunities for students to take on agentive problem-solving roles and to participate in ways that can impact students' dispositions toward the subject and, over time, their sense of themselves as competent learners. In order for teachers to give students these learning opportunities, they must be comfortable with the content of the curriculum. Knowing the curriculum content supports teachers as they plan math lessons with equitable academic discourse (Stein & Smith, 2018).

The role of the school leader is threefold -- allocate time for teachers to learn the mathematics curriculum and plan lessons with their colleagues, make certain there are sufficient and useful resources for teaching math, and gather the aggregate evidence from classrooms to decide what professional learning teachers need. At planning meetings, in addition to ensuring that teachers are planning for the student assets and needs in their classrooms, the teachers need to align the learning with grade level content standards, including the grade levels before and after the year of instruction. In addition to the math textbooks, teachers need to study curriculum maps, pacing guides, and make decisions about power standards and effectively address the issue of deeper learning, not coverage. Use of manipulative in professional learning for teachers supports them to use in classrooms (National Council of Teachers of Mathematics, 2014). Teachers should be able to plan assessment and be data driven about the content including supplementary materials for re-teaching and challenging students. As school leaders conduct mini-observations, they should have individual conversations with teachers about practices; however, they can use that information to guide professional learning (Grissom et al., 2021; Grissom et al., 2013).

Lesson Planning and Implementation

Planning for conceptual understanding in mathematics requires that the teacher plan carefully for academic discourse (Zwiers & Crawford, 2011). As teachers plan, they should start by stating the learning objectives. They should determine what they want students to learn from the lesson. Next, teachers should decide on the assessment that could demonstrate their understanding of the lesson objective and the questions they should ask to assess student learning of the concept (Hattie & Zierer, 2017). Anticipating errors should be considered as teachers are planning (Stein & Smith, 2018). The most effective math lessons include student academic

discourse in problem-solving on a rigorous math task, and the teacher should be fully aware of multiple problem-solving possibilities. Teachers can then be aware of any misunderstanding and anticipate the discourse. Teachers should carefully consider partner sharing, small groups, anticipating errors, sequencing, and selecting as they create daily lesson plans. In lesson plans, teachers should design key questions or question stems that support student engagement (Burbules & Bruce, 2001).

As they implement the lesson, teachers should monitor the students as they solve the problems and elicit explanations from students about students' thoughts processed within their small groups. Next, teachers should select students to present their problem-solving strategies by sequencing and selecting students based on their academic needs from simple to more complex (Smith & Stein, 2015). Many teachers design lessons to give all students equal opportunities to engage in academic discourse. As discussed earlier, equality does not support equitable opportunities. Some students, based on background knowledge and social constructs, should be given more opportunities than others and these opportunities need to be planned as an integral part of the lesson. In a Bambrick-Santoyo (2018) lesson plan example, a teacher simply displays two samples of student work. Paired student discuss the sample solutions. The teacher guides and asks probing questions to students. As the students are engaged in partner discourse, the teacher polls the room to gauge student understanding before beginning the whole class discussion.

Questioning

As teachers engage students in academic discourse, questioning is a key component to guiding student thinking. Teachers should refrain from asking simple questions that result in one word and yes or no responses. Instead, teachers must ask questions that require students to explain their thinking in solving the problem and support other students to construct arguments

that respectfully disagree with the teacher or other students (National Council of Teachers of Mathematics, 2014). Probing questions that guide students toward responses are important. Teachers should ask open-ended questions that delve students into using critical thinking and reasoning skills, especially for understanding conceptual mathematics (Metson, 2020). However, teachers should plan these questions in advance with careful thought. Taking time to plan engaging lessons, including the questions they will ask as opposed to coming up with questions in the moment, is the key to effective teaching (Stein & Smith, 2018). In addition to effective questions, teachers need to plan lessons that include equitable protocols as students solve rigorous tasks for developing reasoning for conceptual mathematics understanding.

Equitable Protocols

Students come to class with different skills and levels of comfort for public speaking therefore need different levels of engagement during instruction (Ladson-Billings, 2009). The practice of giving all students equal opportunity lacks equity (Khalifa, 2018; Muhammad, 2020). As teachers form relationships with and gain knowledge of their students' assets and needs, they can differentiate the levels of support as they engage in academic discourse. The protocols that teachers use should be a systematic process that includes all students. However, due to the diversity of students' needs, understanding how to use equitable practices is vitally important.

Equity for African American Students

Equitable learning is not the same as equal (Khalifa, 2018) because the greatest inequitable treatment in a classroom is giving all students the same level of work and support (Ferguson, 2007). Due to systemic issues of racism, African American students may often be reluctant to share their ideas. The racism in our society may make African Americans feel that their problem-solving skills and even their communication skills are subpar and then are less

likely to contribute to academic discourse (Kendi, 2019; Khalifa, 2018; Muhammad, 2020). According to Kendi (2019), "racist ideas make people of color think less of themselves, which makes them more vulnerable to racist ideas. Racist ideas make White people think more of themselves, which further attracts them to racist ideas" (p. 6). According to Khalifa (2018), "Unfortunately, current forms of dehumanization-containment, criminalization, decentering, 'deficitizing', and so on-within schools are outgrowths of these earlier forms of oppression" (p. 111). In addition, as teachers acknowledge the assets that all students bring to the classroom, they may need to acknowledge their racial and cultural biases as they engage students in meaningful rigorous academic discourse and tasks (Muhammad, 2020). This acknowledgement builds trusting relationships that are the foundation for students to feel safe as they share and express their ideas (Hammond, 2015).

As a first step, teachers need to know the cultural backgrounds of their students, families, and communities so they can fully address the needs of their students. Cultural knowledge includes understanding values, norms, and beliefs (Hammond, 2015) as well as the students' prior experiences in schools that have often sent signals to them of incompetence. Based on a student's culture, teachers can make better decisions about how to engage students (Emdin, 2016). For example, just like English Learners need scaffolds to support engagement in discourse, many African American students need different scaffolds to over self-doubt or other issues that prohibit engagement in discourse. Ferguson (2007) says that African Americans compare their condition with that of the white majority and can often feel a sense of resentment, pessimism, and opposition. As a result, teachers need to provide more encouragement, wait time, and probing and guiding questions when engaging African American students in academic discourse. In addition to rigorous academic tasks that have multiple solutions, teachers need to

intentionally encourage their thinking so they can develop identities as math learners (Boaler & Staples, 2008). “In Greeno’s (2015) theoretical frames of types of questioning patterns and responses in classrooms, he concludes that “[p]ositioning students as authors of important information is probably an important part of positive identity building, but that likely depends on the content of statements made by a teacher and other students” (p. 261). As a result of understanding how the historical and current racism may influence African American learners and how teachers need to ensure participation through their pedagogical choices, teachers need a repertoire effective protocols that equitably engage students in academic discourse and ensure all students value contributing to the discussions.

Protocols

Holding students accountable for actively engaging in public discourse can be challenging for teachers, and protocols that teachers use regularly help students to develop a sense of authority over their thinking. Mathematics lessons protocols such as Frank Lyman’s (1981) “Think-Pair-Share” or “Write-Pair-Share” in which the students take time to solve problems and then share with a partner are engaging as there is accountability to each partner. However, think-time is missing in most classrooms, and taking the necessary time for student thinking is a persistent classroom missed opportunity. If students are given time to think and or write to formulate their answers before engaging in academic discourse with a peer partner peer, they can begin to formulate ideas and then share their thought processes. Other engaging protocols, such as the carousel brainstorming, chalk talk and inside-outside circles are physically moving protocols. Mathematics lessons may include small groups discussion with four or five students sharing answers “round- robin,” in a “whip around” using sentence starters such as “talk moves” or other sentence starter frames that give the students the words to begin the discussion

are helpful when using protocols (Bambrick-Santoyo, 2018). In Metson (2020) study, he reports that several teachers described a surprisingly difference between the ways they expected academic discourse to look in their classrooms with engaged students using critical thinking and actively teaching and learning from one another and the reality of how those conversations actually played out, which often included minimal student participation and recitation of surface-level answers. As teachers plan lessons, they must consider how the conversations may go. Planning and selecting the correct equitably engaging protocol can help solve the problem of student disengagement.

As they select protocols, teachers should ensure the protocols are student centered. Shifting the emphasis from instruction to student interaction is imperative for student learning. The use of Socratic seminars is an example of engaging students in intellectual discourse. The students learn to take turns, defer, appreciate ideas of others without raising hands as they question each other and share ways to solve problems (Tredway, 1995). The primary role of the teacher should be coaching and asking probing questions. Students should be engaged in student-to-student dialogue as they build on each other's ideas and provide each other evidence for deeper learning (Tredway et al., 2019). In all cases, successful protocols require all students to have an opportunity to state problem solving strategies, work out disagreement or confusion, and test solutions with each other.

Summary

The participatory action research (PAR) studied culturally responsive and equitable academic discourse that engages African American students. Research on building trusting relationships and content competency, as teachers planned and implemented lessons with questioning strategies using equitable protocols were in this PAR study. The rigorous level of

questioning were most important as we explored understanding conceptual mathematics with rigorous tasks.

Understanding Conceptual Mathematics with Rigorous Mathematical Tasks

As students prepare for higher levels of mathematics, they must have a strong understanding of mathematical concepts. Conceptual understanding of mathematics is required and the foundation of such understanding is necessary for building procedural fluency (National Council of Teachers of Mathematics, 2014). For example, in a study of 4th and 5th grade students' understanding of equivalence, conceptual knowledge transferred to stronger procedural knowledge and skill, but procedural teaching did not support stronger use of the procedure (Rittle-Johnson & Alibali, 1999). The mathematics must make sense to children. If children make sense of mathematics, they can build on this understanding to learn higher levels of mathematics, develop problem solving skills, and improve procedural knowledge and skill (Boaler & Staples, 2008).

However, teaching conceptual mathematics can be difficult for teachers especially when teaching in an urban setting serving primarily African American students who may have preconceived fear, lack of connection to, and dislike of mathematics instruction (Muhammad, 2020). In this section, I concentrate on the importance of ensuring that African American students have experiences in learning conceptual mathematics. First, I describe the importance of this learning to their long-term goals of college and career readiness. Then, I analyze aspects of rigor, mathematical reasoning, and rigorous mathematical tasks.

College and Career Readiness

To succeed in college and careers, students must be prepared with a solid foundation in mathematics. Many educators and parents place emphasis on acquiring excellent reading and

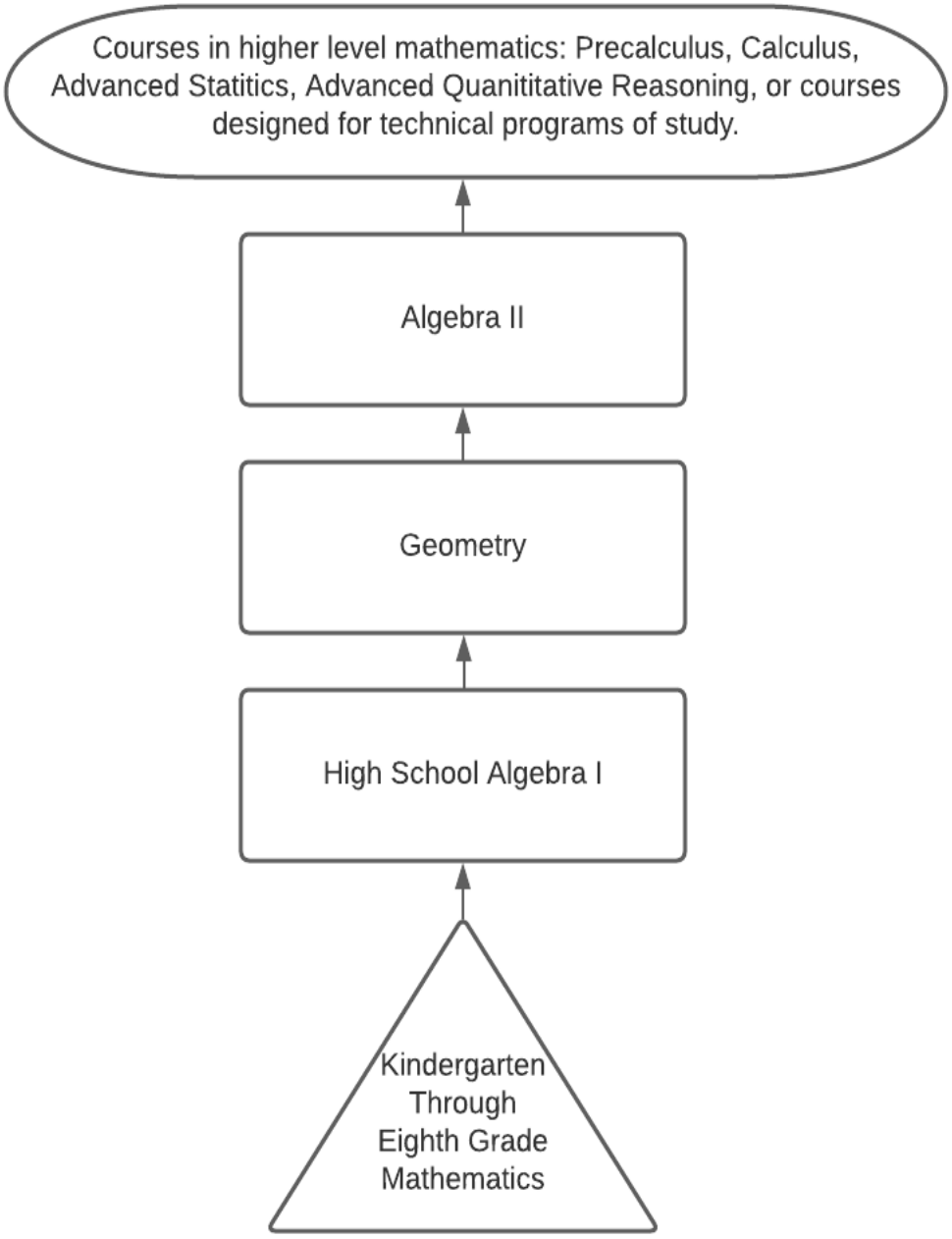
writing skills. However, almost all twenty-first century professions require mathematical skills that include critical thinking, logic, and reasoning (Delpit, 2012). In our society, African Americans are being left out of professional opportunities due to lack of education in mathematics (Kendi, 2019; Moses, 2001). Many educators and parents focus solely on literacy of reading and writing and view illiteracy in mathematics as acceptable (Moses, 2001). Some people in our society say understanding mathematical concepts is not for all people, or that some people are just not good at mathematics. However, effective, conceptual mathematics education has not been a teaching priority, especially to students in urban settings (Moses, 2001). Teachers must be prepared to design and implement mathematics lessons focused on conceptual understanding at the upper elementary school level, the foundation of higher mathematical knowledge (Larson et al., 2012). To ensure all students are given an equitable opportunity to engage in developing conceptual mathematical knowledge so that they can continue to access to mathematics course sequence that prepares them for college, teachers should be able to design and implement conceptual mathematics lessons to support stronger and equitable engagement for students in urban settings, especially African American students (Delpit, 2012). Too often, instead, higher level mathematics functions as a gatekeeper as intermediate algebra and geometry are the lowest levels of mathematics required for four-year college entrance.

In addition, as students leave high school or college and enter careers, high levels of mathematical skills are needed. According to the US Bureaus of Labor Statistics, more than half of all jobs require technology skills, which include mathematics skills. As our future continues to depend on technology, future jobs will require even higher mathematics and technological skills (Moses, 2001). With the adoption of the Common Core State Standards for Mathematics,

the content standards and mathematical practices were developed to support more conceptual mathematical knowledge and understanding.

Content Standards

The Common Core State Standards for Mathematical Content are divided in three areas - the standards, the clusters, and the domains. The standards define what students should understand and be able to do. The clusters summarize groups of related standards and the domains are larger groups of related standards. As teachers use the standards to guide their planning, they often incorporate a balance of procedural lessons, conceptual lessons, and mathematical tasks (CCSSM, 2012). However, to become competent at math, students should not have a heavy focus on only procedures and algorithms. Solving rigorous mathematical tasks in which students apply mathematics to practical situations, and explain how they solved their problems, affords students the opportunities to learn by using their critical thinking skills and effectively develop understanding of the mathematical content. Without taking the time to build the conceptual understanding, students who lack mathematical understanding do not develop fluency in problem solving (Larson et al., 2012). Content standards should be addressed in the mathematics curriculum with a sequence of thoughts and reasoning strategies that build developmentally as appropriate connections are made year by year from previous learning (National Council of Teachers of Mathematics, 2014). This learning progression (see Figure 4), should give students the opportunity to advance in mathematics and develop the skills for college and career readiness. From Kindergarten to Grade 12, students focus on developmentally appropriate levels of:



Note. Adapted from (Reys et al., 2017)

Figure 4. Hierarchical levels of advanced mathematics.

- Counting and Cardinality
- Operations and Algebraic Thinking
- Numbers and Operations in Base Ten
- Numbers and Operations - Fractions
- Measurement and Data
- Geometry
- Ratios and Proportional Relationships
- The Number System
- Expressions and Equations
- Functions
- Statistics and Probability

The goal of using the standards for guidance in teaching is for the students to build upon prior knowledge. Kindergarten through 8th grade mathematics standards prepares students for high school. In the early grades, students must have a clear conceptual understanding of the standards to build upon. As students go to high school, their success in mathematics can lead to advanced levels of mathematics courses (Reys et al., 2007).

Standards for Mathematical Practice

The Common Core State Standards for Mathematics include standards for mathematical practices as well as content standards for describing what students are doing as they learn mathematics (NCTM, 2012). Students will develop ways of thinking about mathematics and build reasoning habits when they learn to use the mathematical practices. These eight practices should be consistent throughout all math instruction (NCTM, 2012).

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

By using these practices, students can recognize the value of studying mathematics and build confidence in knowing they can solve challenging problems through hard work, perseverance and a positive attitude (Larson et al., 2012; NCTM, 2012). In addition, the use of mathematical practices ensures that students are engaged in problem solving discussions and are using critical thinking and reasoning skills. The mathematics standards and practices can prepare students for college and career. Conceptual understanding lessons, in addition to procedural lessons will give the students the knowledge and skills to solve rigorous problems. The level of rigor is a critical aspect of all choices of content and process.

Aspects of Rigor

Effective teachers challenge students with developmentally appropriate problem-solving applications and encourage students to persevere while supporting them with probing questions for productive struggle. The level of rigor in mathematics instruction is therefore important, as students need challenges to build new mathematical knowledge (Reys et al., 2007). As children are taught new mathematical concepts, they should be guided to add the new concepts and skills to existing ones. Each child is different and, therefore, will connect to mathematical concepts in

different ways based on their past experiences. The concept of the depth of knowledge (DOK) refers to the level of rigor in assigned tasks given to students. Verbs are associated with the level of difficulty of the tasks. For example, on the DOK level one, a student is asked to recall, recite, or list math information as a lower level of depth of knowledge. However, on the DOK level four, students should be ready to extend their thinking by proving, creating, applying, or analyzing mathematical information.

Acquiring Conceptual Mathematical Knowledge

Understanding conceptual mathematics means being able to explain the reasons why mathematical procedures work (NCTM, 2014). Students who learn conceptual mathematics can understand connections, reasons, and formulas. Therefore, teachers must focus on how their students learn in order to give students a strong foundation in conceptual mathematical knowledge (Lavinia & Moskowitz, 2012). Children learn best when mathematical topics are appropriate for their development level. Topics should challenge children's thinking but be within the student's zone of proximal development (Vygotsky, 1978). Using manipulatives and models are important because students can use enactive methods to portray mathematical understanding – often before they can verbalize that understanding (Driscoll, 1994). Procedures need to be connected to concepts so students can have a better recall of procedures and are therefore more likely to apply them in when solving math problems (Reys et al., 2007). While students need to know which procedure is appropriate to use to solve specific mathematics problems, students may have other ways of solving problems and have the opportunity to explain their approaches by showing and then explaining their conceptual understanding of the mathematics problems they are solving (Reys et al., 2007). According to the National Council of Teachers of Mathematics (2014), "[f]luency is not a simple idea. Being fluent means that

students are able to choose flexibly among methods and strategies to solve contextual and mathematical problems, they understand and are able to explain their approaches, and they are able to produce accurate answers efficiently" (p. 42). Rushing into mathematical fluency without the proper understanding of mathematical concepts can confuse students and undermine their confidence, make them fearful of mathematics, and even develop mathematics anxiety (NCTM, 2014). Understanding mathematical concepts helps students with procedural recall skills and proves that there are negative consequences for teaching procedural mathematics skills without conceptual understanding. For example, students can get the right answer but could be reluctant to connect procedures towards making meaning of algorithms (Hiebert & Wearne, 1993). Teachers need to help students make connections and see the conceptual and procedural relationships.

Procedural Skill and Fluency

Procedural knowledge is the ability to solve problems using algorithms, steps, and rules. Many teachers were taught mathematics using algorithms and default to the pedagogy used when they learned these skills as they teach in classrooms today – instead of the more complex teaching that requires math content knowledge, pedagogical repertoire, and knowledge of how students learn (Stein & Smith, 2018). Unfortunately, solving mathematical problems to get the right answer was, and still too often is, the major focus of mathematics instruction. Procedural knowledge is definitely important in mathematics; however, both conceptual and procedural understanding are required as they work together for acquiring mathematical knowledge (Reys et al., 2007). Procedural knowledge is learned through drills, repetition of learning steps, or algorithms. The depth of knowledge of procedural lessons is usually on level one as students are asked to recall, recite, and list steps or mathematical facts. Building automaticity with addition,

subtraction, multiplication. and division facts is a needed skill, but when higher-level numbers are used, students struggle without the conceptual understanding from seeing relations, patterns, and connections. As indicated previously, conceptual knowledge supports stronger procedural knowledge and skill, but by primarily using procedural teaching limits student transfer and does not support learning procedures as well as teachers might believe (Rittle-Johnson & Alibali, 1999).

Application in Mathematics

Applying mathematics to real world situations is a critical component of building conceptual knowledge (Berry III et al., 2020). The first criteria of learning theory is the attention of the students so they are ready for learning, and math problems that are not engaging are a non-starter for many students. When teaching mathematics to African American students, the teachers must make the application of math relevant, or students may not connect to the subject matter and ask why they are learning this topic and how it will help them in life (Delpit, 2012). Students should be taught that mathematics exists in nature, sports, music, art, video games, science, and business; using examples from student prior knowledge and experience related to these interests in mathematical applications supports student learning. Teachers should harness the love that students have for these subjects and transform it into a love for mathematics (Muhammad, 2003). Too often students are given mathematics problems detached from their context making the tasks irrelevant and meaningless to them (Berry III et al., 2020). Furthermore, to engage African American students in mathematics, teachers should get to know their interests, and prior knowledge to build authentic mathematical application tasks.

Reasoning in Mathematics

Reasoning in mathematics is how students apply their logic and critical thinking skills to solve problems. As students develop their reasoning abilities, they decide the strategy they will use and eliminate ways that will not work as they reach solutions. As students apply their conceptual understanding to a math problem as opposed to following step by step procedures as algorithms, they engage in creative imagination and reasoning. (National Research Council of the National Academies, 2005) instead of a set of processes or rules that they do not internalize. As students learn to reason, they justify and prove their answers. Using manipulatives and models can help students to portray their thinking and then use the model or manipulative to explain their thinking to another student or the class.

Manipulatives and Models

The use of manipulative materials and models helps elementary students learn conceptual mathematics. Since mathematics can be abstract, the visual representation of manipulative materials and models provide concrete examples for consideration of the mathematical concepts. Visuals and hands-on activities using manipulatives support students as they learn about mathematical relationships such as comparing quantities because they leave a mental impression for future consideration. -Students learn when they have a meaningful context by using everyday objects (National Research Council, 2005). Number lines, base ten blocks, rulers, fraction models, tangrams and the use of grid paper are examples of basic mathematical manipulative materials and models. The use of manipulative materials in developing understanding of the algorithms is essential (Reys et al., 2007). Students should be given time to explore and formulate mathematical ideas with manipulatives materials and draw pictures. The use of popsicle sticks, beans, buttons, pennies, and more are some household items that can support

mathematical conceptual thinking as students apply the concepts to improving their procedural or algorithmic strengths. Tools and objects serve as mediators of learning for students (Katić et al., 2009).

Models of mathematical representations, such as arrays, area models, diagrams, and more can help students connect to concepts about mathematics. Seeing patterns on the one-hundredths chart and fraction circle spinners are some examples. A gradual release of relying on visuals will come as students develop a fluid understanding of mathematical concepts, moving through the cycles of learning that Bruner describes as enactive, kinesthetic, and symbolic (Driscoll, 1994). Students begin learning mathematics with objects, visuals, and other manipulative materials. Then they progress to using their reasoning and critical thinking skills as they learn how numbers relate and connect. Observations of students working on tasks using manipulatives or modes informs the teacher of the students' mathematical logic (Tekkumru et al., 2020). Visuals and hands-on activities using manipulatives support students as they learn about mathematical relationships such as comparing quantities because they leave a mental impression for future consideration (Michaels et al., 2007). The students must be able to explain what they are doing with the manipulative materials and models, which leads to the next findings about the importance of academic discourse during mathematics instruction.

Academic Discourse in Mathematics

The National Council of Teachers of Mathematics (2014) says that "[e]ffective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments" (p. 29). Students learn to make sense of mathematics as they engage in academic discourse and verbally share their problem -solving skills (Stein & Smith, 2018). As students use manipulatives, there is

value in having students work with partners, small groups, or make presentations to the class about how they solved the problem. The metacognitive process of formulating words and expressions is an important part of learning (Zwiers & Crawford, 2011). Through discourse students can clarify understandings, make arguments, defend their thinking, and ask clarifying questions as they learn to see mathematics from perspectives other than their own. Furthermore, African American students in some communities, due to lack of exposure to academic vocabulary, may need the opportunity to learn the academic vernacular that supports their conceptual learning. As students explain their thinking through discussion, being able to explain their thinking in written form becomes a key adjunct to verbal explanations.

Reading and Writing in Mathematics

Numeracy, reading, and writing all work together for student learning. Students must read to follow directions and to solve word problems such as mathematical tasks. As students read to learn mathematics, they should be engaged in answering questions about their readings. Reading to answer questions is more motivating than reading only because the reading was assigned (National Research Council of the National Academies, 2005). As students read about mathematics, they should learn to stop and jot, identify key numbers and vocabulary words, and look for what the problem is asking them to do. Teachers should display mathematics word walls to help students develop mathematical vocabulary: order of operations, definition of terms, and other scaffolds (Parrish, 2010). These scaffolds support students as they write using math terms, concepts, and analytical language. During state testing and other assessments, students are required to write and describe how they solve mathematical problems. Often they are asked to cite evidence and examples. They may write in sentences and use models as a form of communication especially during assessments. In addition, student reflection is useful as they

explain what they did not understand about a lesson or other thoughts about mathematical lessons (Reys et al., 2007). Reading and writing in mathematics are essential for solving mathematical tasks.

Mathematical Tasks

According to the National Council of Teachers of Mathematics (2014), "student learning is greatest in classrooms where the tasks consistently encourage high-level student thinking and reasoning and least in classrooms where the tasks are routinely procedural in nature" (p. 17). Therefore, students must be engaged in rigorous mathematical tasks – sometimes termed ambitious mathematics, for optimal learning. Tasks can be defined as activities that can be used as assessments to collect data about students' understanding of mathematical concepts (Tekkumru-Kisa et al., 2020). Mathematical tasks should be authentic and challenging in that they come from the students' environment and are at DOK level three or four or within the students' reach. In an empirical study of rigorous mathematics tasks, Munter (2014), found that students can maximize their learning potential when teachers consistently implement mathematical tasks that engage students in high levels of thinking with clearly defined expectations. Teachers should communicate high expectations for all students, especially African American students when assigning mathematical tasks; if too many scaffolds or low level tasks are assigned to students, they will not develop the critical thinking skills needed for progression into higher mathematics courses.

Too often African Americans have been discriminated against in mathematics classes with lowered expectations, while comments about their abilities and their lack of participation have been accepted and overlooked (Delpit, 2012). Teachers cannot judge a student's ability to conceptually understand mathematics based on socioeconomic status and race. Although

mathematical tasks have high cognitive demands, teachers cannot transform the tasks into less demanding lessons as they teach (NCTM, 2014). Mathematical tasks should give students the opportunity to actively participate in reasoning and problem solving so they can develop a deeper understanding of conceptual mathematics.

CHAPTER 3: RESEARCH DESIGN

In this participatory action research (PAR) study, I examined how third through fifth grade teachers implemented equitable and culturally responsive academic discourse to support African American students during mathematics instruction (Muhammad, 2020; Zwiers & Crawford, 2011). The PAR theory of action (ToA) for this study was: *If teachers effectively implement academic discourse routines in conceptual mathematics lessons, then teachers will equitable engage African American students.*

The study took place in an urban elementary school in the Oakland Unified School District (OUSD) of California. The teachers in this study worked together to implement equitable and culturally responsive routines that engage students in academic discourse to demonstrate their conceptual understanding of mathematics. Over the course of this research (fourteen months), I observed teachers and had conversations with them about their practices based on the observation data I collected and analyzed. The goal of this study was to fully understand to what extent teachers implement equitable and culturally responsive academic discourse routines to support African American students during mathematics lessons.

In this chapter, I present information about the primary research methodology for this qualitative research study: participatory action research (PAR). The improvement science process (Bryk et al., 2015) and the community learning exchange protocols (Guajardo et al., 2016) are integral to implementing this PAR process. The time frame of the study includes three cycles of research, which I conducted over fourteen months (January 2022-May 2023). In this chapter, I present an overview of the qualitative research process followed by information about the participants, data collection, and data analysis. I conclude this chapter with a discussion of study considerations for limitations, validity, and confidentiality and ethics.

Qualitative Research Process: Participatory Action Research

The intent of this empirical qualitative research study was to answer questions that direct the study's methodology and design (Creswell & Creswell, 2018). Using participatory action research methodology (PAR) in tandem with improvement science processes, the community learning exchange (CLE) axioms and protocols, observation tools, coaching conversation notes, reflective memos, and member checks, I collected and analyzed data. I engaged in three cycles of inquiry. As data was collected, I organized and code the data. As a result of the analysis of the data, I determined categories in the Pre-Cycle emergent themes in PAR Cycle One, and findings in PAR Cycle Two (Saldaña, 2016). With a group of teachers who acted as a co-practitioner researcher group (CPR) in this qualitative action research, I examined teachers' practices as they collaborated to co-design and implement mathematics lessons. As the lead researcher, I observed the process and facilitated coaching conversations with teachers based on data from the observations. In the CPR meetings, I used community learning exchanges (CLEs) protocols, and we identified the assets and challenges of co- designing and implementing conceptual mathematics lessons as we considered the research questions (Guajardo et al., 2016).

The overarching research question is: *How do third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction?* I reviewed three interactive cycles of inquiry that included collecting data for the following research sub-questions:

1. To what extent do teachers effectively plan to use culturally responsive academic discourse routines during mathematics instruction?
2. To what extent do teachers effectively implement culturally responsive academic discourse routines during mathematics instruction?

3. To what extent did observations and post-observations support teachers to shift their practices to be equitable and culturally responsive?
4. How does the process of engaging African American students in equitable and culturally responsive academic discourse during mathematics instruction support my growth and development as an instructional leader?

To further explain the participatory action research process, I discuss participatory action and activist research (Hale, 2008; hunter et al., 2013) that is supported by (1) improvement science processes (Bryk et al., 2015); (2) community learning exchange (CLE) protocols (Guajardo et al., 2016); and (3) the role of praxis in the research process. Then I present the action research cycles.

Action and Activist Research

The research promotes equitable practices and social change; therefore, the participatory action research I choose for this project is activist research. As teachers purposefully engaged African American students in academic discourse, they addressed issues of equity in their classrooms, school, and their school district (hunter et al., 2013). As the teachers involved in this study developed the mindset that African American children are capable of learning conceptual mathematics (Muhammad, 2020), they had to address their unconscious biases, racist stereotypes, and prejudgments that American society has perpetuated against African Americans for centuries (Wilkerson, 2020). The elevation of African American students from the oppressive mindset of others will emerge as the activist research intentionally addresses these historical derogatory thought patterns. The activist action research engaged the CPR in collaborative cycles of inquiry for addressing issues of equity in the school community and being entirely explicit

about equity dimensions and structural causes of inequities (Rigby & Tredway, 2015). The cycles of inquiry that we conducted always included the CPR participants (Bryk et al., 2015). This study was for capacity building and improving teacher practice.

Improvement Science

This study was grounded in improvement science as a key process in enacting participatory action research. Thus, I guided the CPR in learning by doing. (Bryk et al., 2015). To address the focus of practice, I facilitated a conversation with teachers to analyze the assets and challenges of our mathematics' curriculum and instruction, and I presented those in the fishbone in Chapter 1. From this process, the teachers identified the focus of practice (FOP), which is the term we used in this PAR to describe the improvement science problem of practice. In addition, in the improvement science, the fishbone analysis is largely a needs analysis; instead, I concentrated on both assets and challenges using the revision of the fishbone (Bryk et al., 2015). I guided the CPR to use additional methodological measures of improvement science as we utilized the plan, do, study act (PDSA) cycles of inquiry as a basic practice for learning by doing (Bryk et al., 2015). The PDSA cycle is a rapid learning process in which the participants learn from their practice (see Figure 5). In this PAR, the CPR planned goals for designing and implementing conception mathematics lessons. I collected data and document evidence based on these goals. Next, I analyzed the collected data and shared data with teachers via coaching conversations. Finally, the CPR group decided what to do next based on what we learned from the data (Bryk at el., 2015). The PDSA cycle gave the teachers an opportunity to learn how to change their practices and make incremental improvements before making larger changes (Bryk et al., 2015).

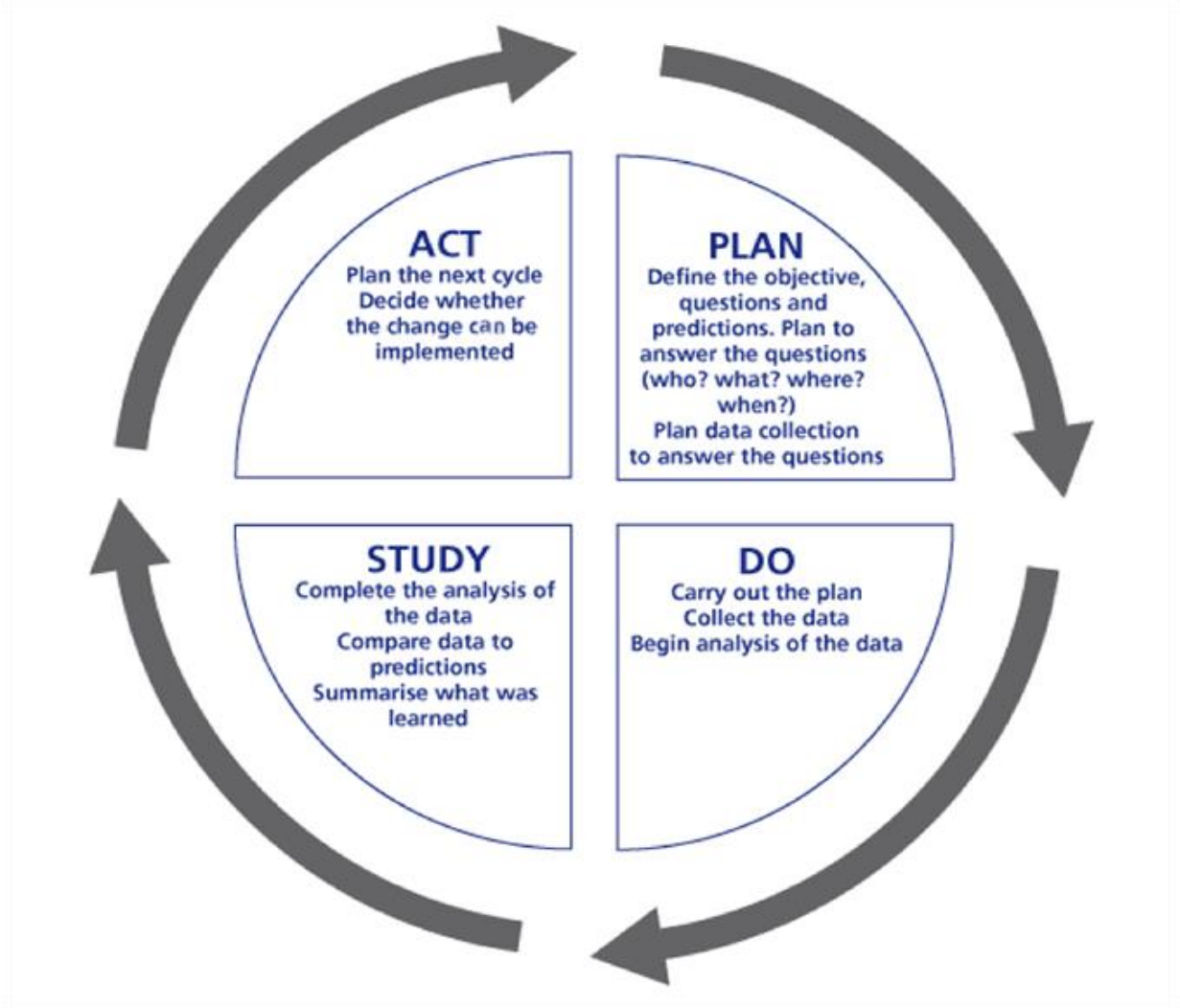


Figure 5. Plan Do Study Act (PDSA) cycle of inquiry model.

Similar to the Japanese lesson study (Lewis, 2007), teachers chose an improvement aim, and, through cycles of study, they agreed on implementing changes that resulted in the desired improvements. The participation in the CPR and sharing in the community learning exchange (CLE) were key parts of the research design methodology and gave us the opportunity to reflect on progress with meaningful protocols as discussed next.

Community Learning Exchange Processes

The Community Learning Exchange (CLE) is an intentional connection of people directly involved in the context engaging in the use of particular protocols to support their collective understanding (Guajardo et al., 2016). The process leads to choices that respond to the school community's unique situation and needs (Guajardo et al., 2016). The purpose of the CLE in this study was to solidify the relationships in the CPR group so that they could depend on each other for collaboration and so they could be warm demanders of each other in improving their instructional practices (Delpit, 2012; Ware, 2006). I collected evidence of CLE artifacts from the CPR group during our regular meetings so that we could learn about the ongoing assets and challenges of implementing equitable and culturally responsive academic discourse routines that engage African American students during conceptual mathematics instruction. Reflecting on the findings of the CLE, we kept our work related to the five CLE axioms that are:

1. Learning and leadership are dynamic social processes.
2. Conversations are critical and central pedagogical processes.
3. The people closest to the issues are best situated to discover answers to local concerns.
4. Crossing boundaries enriches the development and educational process.

5. Hope and change are built on assets and dreams of locals and their communities (Guajardo et al., 2016, pp. 24-27).

Although all five of the axioms are important to the CLE, our inquiry focused on axiom three in which the teachers had the opportunity to share from their practices as they are the people closest to the issues and best situated to discover how to meet the needs of the focus of practice. The teachers, as members of the CPR had the power and voice to specifically name the assets and challenges of mathematics instruction. As a part of this action research, I created gracious space and used the CLE processes to support critical conversations about the pedagogical process and the relationships needed for the activist and action research project. Ongoing reflective memos about the actions in this study and the role of praxis are important.

Role of Praxis

Reflection was critical to a PAR study (Freire, 1970). The praxis – deep reflection with the persons engaged in the research who generativity pose problems of practice –is central to activist research and the actions that we took in this study. After the CPR meetings, the PDSA cycles, the lesson observations, the CLEs, and the coaching conversations, as the lead researcher, I wrote reflective memos about the process of each action. As I reflected and revised each PAR cycle, I made plans to support and guide the CPR toward improvement based on the analysis of the data. I used these reflective memos for my personal development as a school leader, which I discussed in more detail at the end of this study.

I gave CPR members opportunities to reflect on the process of implementing equitable and culturally responsive academic discourse routines to support African American students during conceptual mathematics lessons. As the CPR members engaged in the PDSA cycles, read articles, participate in the CLE processes, and the coaching conversations, they reflected by

writing about the successes and challenges of the process. The CPR members reflected on the observation data as they planned their next steps for implementing equitable and culturally responsive academic discourse routines during conceptual mathematics lessons. I used my reflections and the CPR reflections to support and guide this study to improve teaching conceptual mathematics lessons that engage African American students.

Action Research Cycles

In the participatory action research, we intend to engage in three improvement cycles (see Table 4). During each cycle, the PAR group collected data using cycles of inquiry. As the teachers followed mathematics pacing guidelines, the mathematical standards taught changed with each cycle but the methodology and focus on engaging African American students in understanding conceptual mathematical thinking remained.

Participants, Data Collection, and Analysis

The primary participants in the PAR study were the co-practitioner researcher (CPR) members who included five classroom teachers. They were closely tied to the project and study throughout all cycles of inquiry and provided feedback to the lead researcher. I invited five teachers in the third-fifth grade to participate. I used multiple methods of collecting qualitative data and triangulated the data with other sources for validity. As a CPR team, I shared the analysis of the data in coaching conversations and in the CPR meetings. I collected and analyzed observation evidence, community learning exchanges artifacts, reflective memos, field notes, and CPR meeting notes. I conducted member checks as an additional data source. I shared the data with the CPR to analyze during cycles of inquiry to help inform our next action steps. During the PAR project, the CPR analyzed data with the intent of reflecting and learning from our actions. Next, I discussed the participants, and specific data collection and analysis.

Table 4

Research Cycles of Inquiry

Research Cycle	Activities
PAR Pre-Cycle Spring 2022	● Invite CPR participants and start CPR meetings ● Establish equitable protocols for questioning and calling on ● Facilitate professional development on culturally responsive practices
PAR Cycle One Fall 2022	● Co-design and implement conceptual mathematics lessons ● Facilitate professional development on culturally responsive practices and anti-racist practices ● Observe classrooms ● Facilitate coaching conversations ● Facilitate CPR meetings with PDSA cycles of inquiry ● Facilitate CLE meetings ● Write reflective memos and field notes ● Conduct member checks ● Administer CALL survey
PAR Cycle Two Spring 2023	● Co-design conceptual mathematics lessons ● Observe classrooms ● Conduct peer classroom observations and reflection ● Facilitate coach conversations ● Facilitate CPR meetings with PDSA cycles of inquiry ● Facilitate CLE meetings ● Write reflective memos and field notes ● Conduct member check

Co-Participant Researchers (CPR) and Other Participants

The CPR group in this research project was critical to the PAR study as they used the inquiry process to direct the focus of the study (Bryk et al., 2015). In this PAR study, as the school principal, I was the lead researcher working with third through fifth grade teachers. The teacher team was the CPR group of five participants. As a CPR group, our goal was to implement equitable and culturally responsive academic discourse routines conceptual that engage African American students during mathematics instruction. All participants agreed to participate in this research by signing consent forms (see Appendix D) that explain the terms of the study. We agreed to use designated professional learning communities (PLC) scheduled time to co-design the conceptual mathematics lessons and go through cycles of inquiry about the implementation of the lessons. In addition, teachers met with the principal for coaching sessions during the school day and made peer observations of each other.

I selected the participants by using purposeful sampling (Creswell & Creswell, 2018). The participants were chosen to participate in this study and were not selected randomly. In this PAR study, I invited teachers because of the grade level they teach and because they expressed an interest in improving their practices. As I expected, all third through fifth grade teachers at the school participated with me in the PAR (see Table 5).

Data Collection

All of the data collected and analyzed served the purpose of answering the research questions for this study. As a participatory research group, collecting and analyzing data is required to understand the effectiveness of our work (Creswell & Creswell, 2018). I used several forms of data collection and triangulated all data to ensure the validity of evidence.

Table 5

PAR Research Questions and Data Sources

Overarching Question: *How do third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction?*

Research Sub-Questions	Data Source	Triangulated with ...
1. To what extent do teachers effectively plan to use culturally responsive academic discourse routines during mathematics instruction?	● Documents ● CLE Artifacts	● Reflective Memos ● Member checks
2. To what extent do teachers effectively implement culturally responsive academic discourse routines during mathematics instruction?	● Classroom Observation tools ● Coaching conversation protocols ● CLE artifacts	● Reflective memos ● Member checks
3 . To what extent did observations and post-observation conversations support teachers to shift their practices to be equitable and culturally relevant?	● Classroom observation tools ● Coaching conversation protocols ● CLE artifacts	● Reflective memos ● Member Checks ●
4. How does the process of engaging African American students in equitable and culturally responsive academic discourse during mathematics instruction support my growth and development as an instructional leader?	● Reflective Memos	● Coaching Conversation Protocols ● Member checks

Observations

We used observation protocols to record information while observing. I used pre-established codes and open coding (Creswell & Creswell, 2018; Saldaña, 2016). Following the observations, I met with teachers individually to review the data collected and hold coaching conversations. As a whole, the CPR group met to debrief observations and used the data to plan next steps (see these appendices include these observation tools: E: Calling On, F: Question Form & G: Questions Level.

Coaching Conversations

I used the coaching conversation protocol to record, transcribe, and guide the conversation about the data collected during the classroom observations. During these sessions, I asked open-ended questions to engage the participants in sharing their opinions and reflections based on the observation data. I used the coaching conversation to support teachers as they strived to improve their teaching practices (Aguilar, 2016). I recorded, transcribed, and coded the transcriptions of the coaching conversations using the protocol codes that have been validated.

Documents

We held regular CPR meetings during each PAR cycle. At those meetings, we collected these documents: agendas, planning materials, written reflections, and meeting notes.

Community Learning Exchange Artifacts

Using the CLE protocols during our CPR meetings during each PAR cycle, I collected artifacts to code and analyze. I collected and analyzed data specific about the activity and the research questions.

Reflective Memos

I wrote reflective memos on a regular basis after CPR meetings, observations, the CLE, and coaching conversations. The reflective memos modeled the Kolb (1984) experiential learning process. The process of reflecting on an experience leads to making changes for improvement. I gave time to the CPR group to write reflective memos after meetings, coaching conversations, and the CLE.

Member Checks

Member checks gave all CRP participants the opportunity to review the data I analyzed in this study and "check the accuracy of the account…deciding whether the description is complete and realistic, if the themes are accurate to include, and if the interpretations are fair and representative" (Creswell & Guetterman, 2018, p. 261). I conducted member checks at the conclusion of each cycle of inquiry.

Data Analysis

I analyzed the data from classroom observations and discussed the analysis with the teachers so that each of them could use the data to make decisions about their next steps. All CPR members engaged in member checks during each cycle of inquiry. As a school that practices data-driven instruction, we looked for what the data said about our practice. For example, I coded an observation for types of questions using protocol codes that are pre-determined and share frequency data with the teacher (Saldaña, 2016). Then, I analyzed the data to reflect on the types of questions with each teacher so the teacher can make decisions about level of question and to whom the questions were addressed. In another example, I analyzed the evidence using the protocol codes on the calling on tool (see Appendix E), shared the analysis with the teacher, and had a post-observation conversation in which we discuss the data. In each

case, I tallied the students called on by noting their gender, ethnicity, and frequency to determine equitable practices. I aggregated the data and determined grade level standards and the level of rigor of the mathematics lessons. In the Pre-Cycle, I developed emergent categories; in PAR findings for the study using codes (see Figure 6). In these examples of iterative use of data, we Cycle One—emergent themes, and, by PAR Cycle Two, I determined the themes and present practiced participatory action and activist research, using classroom evidence with the persons closest to the work to determine next steps about equitable practices. At the conclusion of each cycle, I conducted member checks with the CPR team.

Study Considerations: Limitations, Validity, and Confidentiality and Ethics

In the PAR project and study, I used qualitative methodology with the goal of understanding a complex situation at a school site with various dimensions such as the beliefs, values, backgrounds, content knowledge, and relationships of the PAR participants. Thus, I considered several elements that may influence the study. I discussed the limitations of the study, the validity factors, and confidentiality and ethics.

Limitations

A limitation of this qualitative research was that I was not able to quantify some aspects of this study. However, I produced an in-depth understanding of the information obtained from a qualitative analysis of the focus of practice (Quierós et al., 2017). As the lead researcher and participant in this PAR study, after classroom observations and witnessing teachers not engaging students in critical thinking about mathematical concepts, I confirmed the preliminary premise of the focus of practice for this research: *How can third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students*

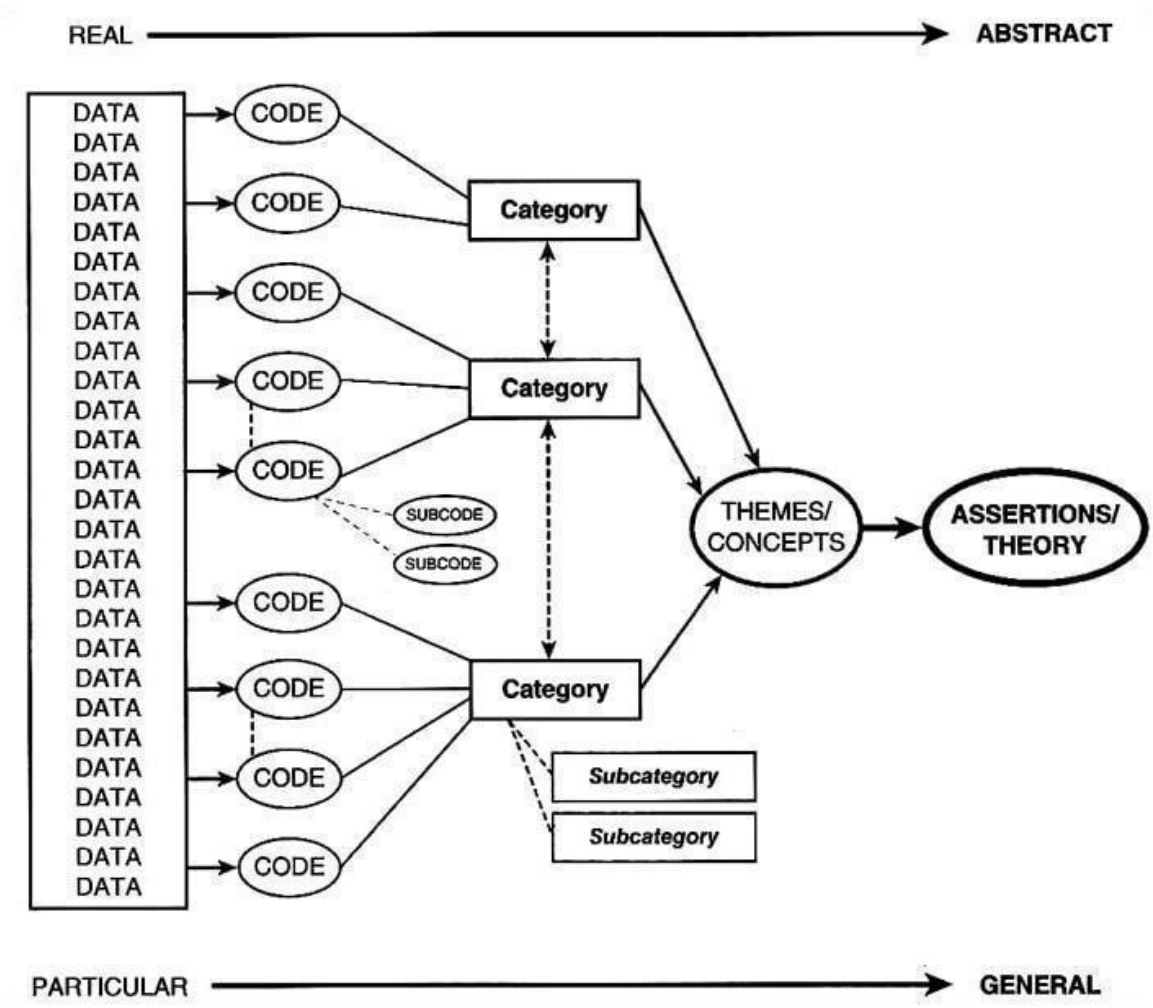


Figure 6. Coding and analysis process includes raw data, codes, categories, themes, and assertions/theory.

during mathematics instruction? I reported observation and conversation data and triangulate with memos to determine how the teachers are able to shift their practices.

A second limitation was my role in teacher evaluations. I conducted particular observations for teachers who were required to have an evaluation and made clear to the teachers if teachers that those observations were different than the evidence-based tools and post-observation conversations that we had as a part of the PAR. I conducted shorter observations using the protocols I have designated in this project and have regular conversations with teachers for the purpose of growth and development. In the CPR meetings, I carefully facilitated those conversations to increase equitable voices of teachers and stress the collaborative process we engaged in to improve student access and rigor.

Finally, the mindset and teacher efficacy about the capability of African American students was another study limitation. As historical prejudice and racist strategies have been acceptable in classrooms for centuries (Kendi, 2019), the goal of the activist and action research study was to ensure that all participants examine their habits and practices when it comes to teaching African American children. Teachers planned equitable practices such as calling on African American students during academic discussions with thought-provoking questions during classroom mathematics lessons (Muhammad, 2020). Teachers must have previously built trusting relationships with students so they feel comfortable about learning new ideas through taking chances and expressing their ideas. As the CPR group used the data from classroom observations and coaching conversations, the teachers made decisions about improving culturally responsive practices. Member checks and peer debriefing supported the inclusion of multiple perspectives with the intention of supporting internal validity. Although the use of culturally

relevant and antiracist practices was a goal of this prolonged study, there was no guarantee that all participants would shift their thinking if cultural biases became obvious to the observers.

Internal Validity

As the primary researcher in this PAR group and the school principal, I was cautious about maintaining balance and an open mind so that the study was valid. Therefore, the CPR group checked all data analysis in member checks (Creswell & Guetterman, 2018). As the lead researcher, I supported valid data by reviewing multiple sources of data artifacts including notes from prolonged engagement, persistent observation, triangulation, reflective memos, peer debriefing and participant feedback (Quierós, 2017). The CPR members and I wrote reflective memos. The dialogue of the CPR members was important as they made meaning of their equitable culturally responsive academic discourse practices and shared reflections (Billings & Fitzgerald, 2002). Because I used qualitative methods in this study that resulted in concrete findings, the focus of practice of this study unveiled results that cannot be attained with traditional experimental design methods (Gerdes & Conn, 2001). The qualitative data supported the growth and development of teachers. With a collection and analysis of multiple forms of evidence so that I could triangulate these sources, the evidence of study was considered trustworthy (see Figure 7).

In addition, with greater specificity, the methods used to ensure credibility of the research establish trustworthiness used the following techniques:

- Prolonged engagement. The researcher is actively involved in the setting and with the participants for an extended time (Fourteen months, three cycles of inquiry).
- Persistent observation. The researcher utilizes a direct and probing mode of inquiry, over time, in an attempt to “dig deeper” and uncover something as yet unknown.

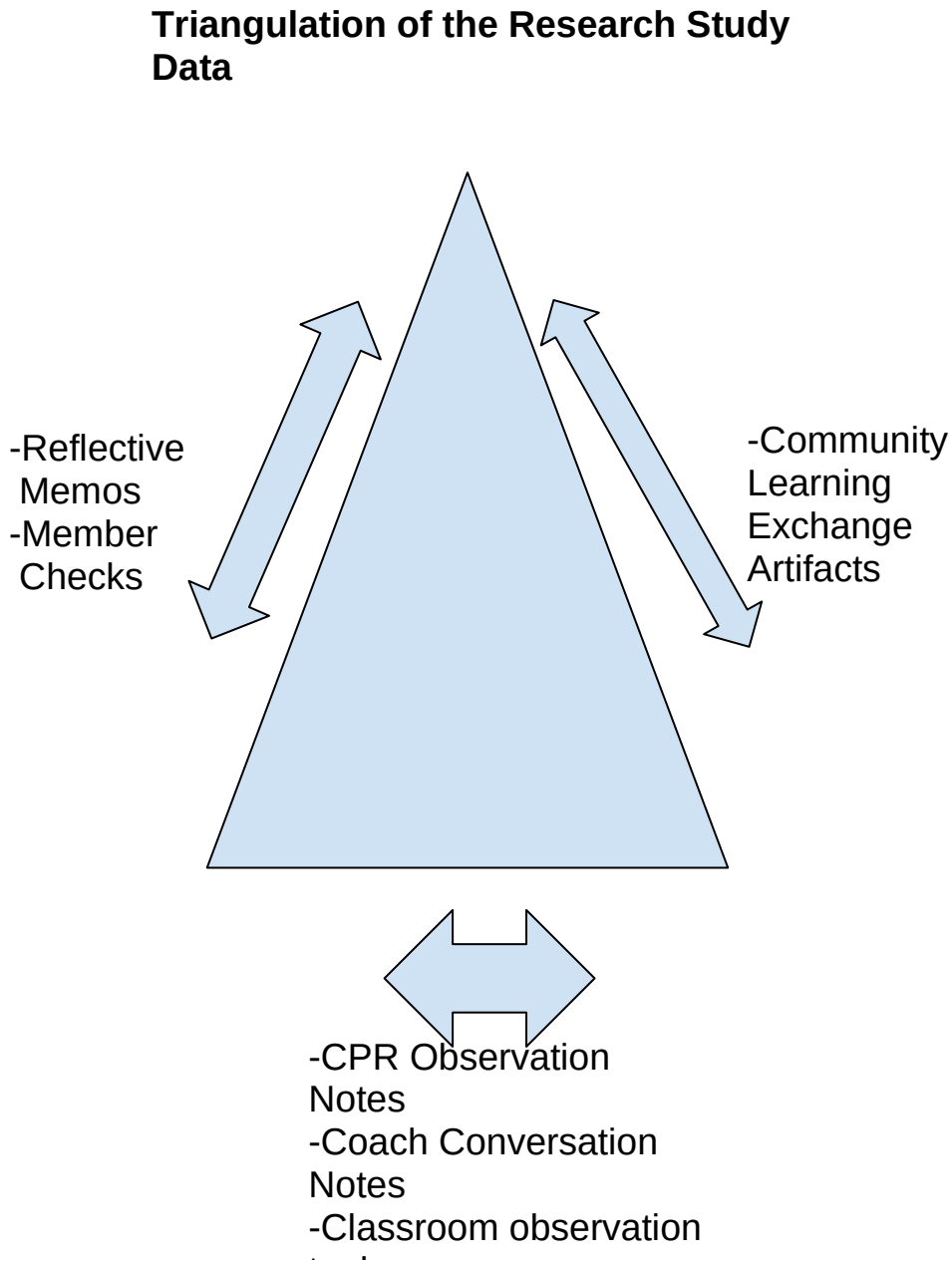


Figure 7. Triangulated data for validity.

- Triangulation. The researcher determines how the data "cross" and confirm other data and then decides on common findings from different sources
- Member checking. The researcher allows the participants an opportunity to clarify their comments, checking for understanding, as if the researcher is asking, "Did I get this right when you said…?" or "What I think I heard you say was….
- Referential adequacy. The researcher utilizes an extensive field notebook and log to document methodological decisions and to make note of personal thoughts or reflections that might occur concerning the data.
- Peer debriefing. The researcher is "debriefed" by a third party who is familiar with the research but not directly involved. The debriefing is a means for the researcher to "stay focused" and to cross-check aspects of data concerning the evolution of the grounded theory " (Gerdes & Conn, 2001, p. 187).

External Validity

The participatory PAR study aligned with the mission, vision, and core values of the Oakland Unified School District (OUSD). The study can be generalized to the scope of work of OUSD; however, only the process of this study should be considered transferable or externally valid to other schools or districts. The outcomes of this study are specific to the PAR co-participants and the specific school involved in the project. Caution should be taken when applying the results of this study to other schools or districts considering the specific needs of the school involved. The research questions for this study are from a group of teachers in a CLE and thus are specific to the needs identified by the people closest to the work at this particular school site. As the study progresses, I based the actions and next steps of the research process on the

analysis of the collected evidence. Adjustments to guide the group continued to unfold in the process of the research.

Confidentiality and Ethical Consideration

As a school principal, I engaged teachers from the third through fifth grade classes. I asked all participants to give consent and sign consent forms without any coercion or obligation. I ensured they were aware that they could terminate their consent at any time without any form of reprisal. There was a clear understanding that termination of the research project could occur anytime without regard to reason. Approval to conduct the study was given by my direct supervisor, school district officials, and is included (see Appendix C). I have completed the Institutional Review Board Collaborative Institutional Training Initiative (IRB CITI) (see Appendix B) and received certification validation from January 2021 through January 2024 to adhere to the ethical requirements of human research (see Appendix A).

All of the participants recognized that building trusting relations with each other and students support the social and emotional well-being of African American students as they develop an understanding of conceptual mathematics. I sent emails and held meetings with each participant individually to ask them about their willingness to participate in the study. Upon verbal agreement, I had each CPR member sign a consent form prior to the official start of the research study. I clearly communicated that they could withdraw from the study at any time. As the school site leader, I have built trusting relationships with the participants, and I assured them that I would only use the data for the study and for research purposes. I did not use the data to evaluate their progress as educators. Rather, I used the data in a non-judgmental fashion with transparency for all CPR members. I established all appropriate consent prior to beginning the study.

I asked all participants to sign the required consent forms (see Appendix D) approved by East Carolina University's Institutional Review Board (ECU IRB). I clearly informed all participants that the participation was voluntary. I informed participants that the security of the data collected and confidentiality would be maintained through the following procedures (Creswell & Creswell, 2018):

1. Data files including important and personal papers are stored in a locked file cabinet in the administrator's office.
2. All electronic forms for data collection are kept in a password protected file.
3. Data and copies of reports were shared with all members of the CPR group for purposes of transparency, improvement, and reflection.
4. I will destroy all data after 3 years.

Conclusion

The goal of this chapter was to provide a well-articulated understanding of the participatory action research design and methodology. The empirical qualitative research study was intended to respond to the overarching research question: *How can third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instructions?* The in-depth study includes a literature analysis of communities of practice, academic discourse with culturally responsive practices, and rigorous mathematical tasks for conceptual understanding.

In the PAR project and study of three inquiry cycles, I facilitated the use of improvement science and community learning exchange processes to address the research questions. As the lead researcher, I collected, analyzed, and triangulated multiple forms of data to determine patterns and support the CPR members to determine next steps. I grounded the study by using

the CLE axioms, which are essential, to expand the social aspects and pedagogical approaches of the PAR project. Acknowledging and addressing the historical prejudices and racist practices against African American constituted an action and activist research study as issues of equitable practices were critical factors in the study. In addition to the qualitative research process, the participants, methods of data collection, data analysis, study limitations, confidentiality and ethical considerations are detailed in this chapter. In Chapter 4, I discuss the categories from action research Pre-Cycle.

CHAPTER 4: PARTICIPATORY ACTION RESEARCH (PAR) PRE-CYCLE

In this participatory action research (PAR) project and study, I focused on examining how third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction. For the purpose of this study, I collaborated with five teachers who formed a co-practitioner researcher (CPR) group; we used the Community Learning Exchange (CLE) processes, which provided an opportunity for school community members to share suggestions for making improvements (Guajardo et al., 2016). I used the data from the CPR group activities and the CLE to inform this qualitative research project and study. In this chapter, I describe where the study took place and the people involved in this study. Then, I share the process of how I established the CPR group, set up the Community Learning Exchange (CLE) processes, and collected and analyzed data. Finally, I discuss how I coded the data and created categories related to the process and content of the study and examined how these categories connected to the research questions.

PAR Context

In this section, I describe the school context including the history, location, and demographics of the school. The micro context of the school within the meso context of the district is critical to implementing and understanding the evidence from this study. I provide descriptions of the co-practitioner research group as I share details about each member.

School Context

The participatory action research (PAR) project and study took place in an urban school in Oakland, California, in which 72% of the students qualify for Title One funding. The population of the school is 342 students, thirteen TK-5 general education classroom teachers, one science preparation teacher, two teachers on special assignments and four special education

teachers. The school was originally built in 1883 to serve the families in the community who worked in support of the Mountain View Cemetery just two blocks north of the school. The school is situated in a bustling business community that is well known for cultural restaurants, florists, and small shops. Five blocks south of the school is Oakland's largest medical facility, where several school parents work. Our school, in the Oakland Unified School District, boasts pride in our ethnic diversity; we respect our cultural heritage and uplift it in our classrooms daily. Our school staff motto is, "We are working to ensure academic and social success for EVERY STUDENT! EVERY STUDENT THRIVES!"

The demographics of the school do not necessarily represent the neighborhood population since many of our students come from across the city. Our school population includes several ethnic groups, with African Americans being the largest population. According to the 2019 California School Accountability Report Card (SARC), the student population of 342 students reported their race and ethnicity as 49% African American, 8.5% Asian, 17.9% Latino, 8.5% White, 0.9% Native American, 1.5% Filipino, .6% Pacific Islander, and 9.1% two or more races. The California SARC reports that 72.4% of the students are socioeconomically disadvantaged, 19.4% are English language learners, 14.1% are students with disabilities, .3% are foster youth, and .6% are unsheltered. Dedicated and hardworking teachers (n=20) and school staff are working toward the goal of serving all students.

CPR Group

In the PAR Pre Cycle, I established the co-practitioner researcher (CPR) group. As the school leader and the lead practitioner researcher, I invited the third through fifth grade teachers to participate in this study as I noticed a greater need of teaching conceptual mathematics with culturally responsive academic discourse in the upper elementary grade levels. I had observed

that the mathematics curriculum and teaching practice focus was primarily on mathematics procedures without teaching an understanding of the mathematical concepts. The teachers I invited to join the co-practitioner research team were eager to explore methods to engage African American students in math lessons that focus on students' conceptual understanding of mathematics concepts using culturally responsive academic discourse as aligned to grade level mathematics standards. All of the teachers have leadership responsibilities beyond the classroom.

To form the CPR group, I met with the teachers individually and described the PAR project. One teacher had questions about the time commitment. Another stated he was elated as he sees the need for more conceptual mathematics lessons and student engagement in academic discourse using culturally responsive practices. Ultimately, all invited teachers agreed to participate in the study, which included two third grade teachers, one fourth grade teacher, one fourth and fifth grade combination class teacher, and one fifth grade teacher.

Teacher A, an African American in his early thirties, began teaching at our school eight years ago as an AmeriCorps teacher in our after-school program. At that time, he was a recent college graduate. The following year, I hired him as the computer lab teacher. For the past six years, Teacher A has successfully taught third grade. He has developed excellent teaching skills, and his students show growth in mathematics every year. During our discussion about our individual journeys with learning mathematics, he shared that he began struggling to understand mathematics in middle school. He worked hard to get passing grades. Once in college, he had professors and tutors that helped him understand mathematics. He serves as the teacher liaison to our after-school program.

Three years ago, Teacher B, a white European American female in her mid-40s, moved to teaching 3rd grade after teaching kindergarten and transitional kindergarten for five years at our school. She was a former preschool director with ten years of experience when she joined our team as a student teacher in a fourth grade class. The year following student teaching, she was hired to teach kindergarten. She and a team of two other kindergarten teachers had a goal to provide a strong foundation in mathematics for students; 90% of her kindergarten students ended the year at or above grade level in her classes. After three years as a kindergarten teacher, Teacher B moved into the position as teacher of the newly opened transitional kindergarten program at our school. After two years, Teacher B volunteered to teach third grade after the school experienced some issues with teacher stability in the upper grades. Her students show growth in all subjects each year. She manages our school website. She continues to show love and compassion as she works tirelessly to give her students excellent learning opportunities, including an extensive classroom library she has set up for her students.

Teacher C, an African American male in his early 30s, has been at our school for four years and currently teaches 4th grade. He previously taught 3rd grade, then left for a year and returned as a 4th and 5th grade combination class teacher. Teacher C has many classroom management systems, structures, and student engagement practices that engage the students. Teacher C is a former PE teacher from an affluent school with a majority White population. During his interview for the teaching position, I informed him that our school served predominantly low income families of color; he stated he went into teaching to serve exactly those students. Teacher C is a no-nonsense, creative teacher who incorporates art and project-based learning activities in his daily lessons. Teacher C serves on our Faculty Council and is a school leader.

Teacher D, an African American male in his early 50s, is new to our school but not new to teaching. Most of his experience has been teaching at the middle or high school level. Last year, he taught at a district school that served middle and high school students who have had disciplinary hearings resulting in expulsion. As an African American male, he is committed to serving children of color. He has built the reputation of having excellent behavior management as he requires respect from his students. Teaching a combination 4th and 5th grade class, Teacher D is learning both grade level mathematics standards. He engages students in developing oral speaking and debate skills and teaches students to play chess during recess. Teacher D has many interests and has recently retired from volunteering as a forensic diver with the county sheriffs' department. He is the co-owner of a popular restaurant in the historic old Oakland area and studies fencing.

Teacher E, a White female in her early 30s, is teaching 5th grade as a first year teacher at our school. She previously taught 2nd grade for three years at an urban charter school in Oakland that closed. She began her career working on Wall Street in the marketing and advertising field, but she did not find that field of work fulfilling and transitioned into education. She fell in love with teaching after working as a paraeducator. She is passionate about helping students and plans engaging lessons. She is working on managing student behavior, as the social and emotional demands for her students proved more challenging than usual following one and a half years of online learning mandated by the CO-VID 19 pandemic protocols. Teacher E serves as the School Site Council's secretary and attends all school events. She planned the 5th grade Casino Night, which engaged students in mathematics games.

The co-practitioner researcher (CPR) group is described in Table 6 with anonymous names, grade levels, ethnicity, years of teaching experience at our school and credentialing status.

PAR Pre-Cycle Process

The Internal Revenue Board (IRB) of East Carolina University and the Oakland Unified School District approved the PAR project in December 2021. I began the PAR Pre-Cycle in January 2022 by sharing an overview of the project with the third through fifth grade teachers in a team meeting. Each participant signed the CPR/CLE Group Adults consent form (see Appendix C).

Over the course of one academic semester (January-May 2022), I facilitated activities for the PAR Pre-Cycle. The key meetings for the January to May 2022 PAR Pre-Cycle included: three CPR meetings to focus on a mathematics journey line, antiracist practices, and equitable academic discussions. We concluded the cycle with a CLE to explore our understanding of what is needed to teach conceptual mathematics (see Table 7). I recorded and transcribed those meetings and field notes during all meetings for data collection and coding purposes. I wrote and coded reflective memos. Using the collected artifacts, I used an open coding inductive process with a high degree of *in vivo* coding to develop emergent categories (Saldaña, 2016). By reflecting on the coding process over several passes at the coding, I developed a better understanding and meaning of the collected data.

CPR Meetings

During the PAR Pre-Cycle, we had three CPR meetings. In our first CPR meeting in January 2022, we explored our relationship with mathematics through sharing our mathematics journey lines. We began the meeting with dynamic mindfulness in which all participants were invited to participate in deep breathing and relaxation techniques. The dynamic mindfulness

Table 6

Co-Practitioner Researcher (CPR) Group

Teacher Name	Grade Level	Ethnicity	Years at the School	Teaching Experience	Credentials
Teacher A	3rd	African American	6	6 years	Tenured, Multiple Subject Credential
Teacher B	3rd	White	8 (6 – Pre K-K, 2 - 3rd grade)	18 years	Tenured, Early Childhood and Multiple Subject Credential
Teacher C	4th	African American	3	4 years	Tenured, Multiple Subject Credential
Teacher D	4th/5th	African American	0	3 years	Tenured, Multiple Subject Credential
Teacher E	5th	White	New	2 years	Probationary, Multiple Subject Credential

Table 7

PAR Pre-Cycle Timeline

Timeline	Activities	Participants
January 2022	CPR Meeting-Invite CPR participants; Journey Line	CPR Group
February 2022	CPR Meeting- Anti-racist practice: Golden Line from Kendi X, How to be an Antiracist.	CPR Group
March 2022	CPR Meeting- Academic Discourse	CPR Group
April 2022	CPR Meeting- Equitable Academic Discourse	CPR Group
May 2022	Community Learning Exchange- What do we need to engage students in learning conceptual mathematics?	CPR Group

process helps participants release the events of the teaching day and focus on being present. The goal of the first meeting was for participants to share their mathematical journeys as students.

Each teacher plotted their mathematical journey as a student and shared their experiences with the group. By sharing our mathematics journeys, we were able to see the assets and challenges that we experienced as students. The math journey line process helped us get to know each other, was the foundation for building trusting relationships, and brought the importance of quality and equitable mathematics instruction to the forefront.

During our next CPR meeting, the participants engaged in conversations about race which supported the understanding of the need to engage African American students in academic discourse during mathematics instruction. We learned that African Americans often do not have a comfort level with mathematics instruction, which helped shed light on the importance of engagement for African American students (Moses, 2001). Using a protocol called the Golden Line, we discussed the book we were studying, *How to be an Antiracist*, by Ibrahim X. Kendi (2019). The CPR members read excerpts from the first chapter, which explains that we all have some racist ideas and that we need to be conscious about our racism and work towards becoming antiracist. Each CPR member highlighted a line or passage from the excerpt that resonated with them. Each person shared his or her *golden line* with the group. All group members responded to each other's choices in the reading, and the person who shared the passage made the final comment. During this CPR meeting, the participants seemed to be more comfortable in discussing race and what it means to be an antiracist.

In March 2022, the CPR group discussed why academic discourse is important and the ways in which we engage students in equitable academic discourse during mathematics instruction. Teachers shared that students should have the opportunity to discuss problem-solving

strategies with groups. As teachers learned from Zwiers and Crawfprd (2011), giving students time to discuss their thoughts before actually undertaking the tasks helps them understand the tasks and formulate their problem-solving thoughts. Teachers shared that they used discussion protocols and questioning strategies as students engaged in small group discussions; and think, pair, share discussions to engage students in academic discourse about mathematics. Teachers agreed that there were some students who dominated the discussions and others that preferred not to join the discussions. We committed to using more strategies to equitably engage all students.

At the final meeting, the Community Learning Exchange (CLE), we discussed the new district-adopted mathematics curriculum and recognized the need for our students to master mathematical concepts. Teachers shared what they needed in order to teach students conceptual understanding of the grade level mathematics standards. I captured responses in the meeting notes. I reflected upon, analyzed, and coded the captured information to serve as data for this research project. Next, I analyzed the data to determine codes and emergent categories that were a result of data from the meetings and activities with the CPR group.

Data Collection and Analysis: Coding and Developing a Codebook

For coding, I collected data from all CPR group meetings, the mathematics journey line narratives, the Community Learning Exchange (CLE), and my personal reflective notes related to my focus of practice. Coding is a process of identifying data items such as transcripts, notes, photographs, or images and searching to identify concepts and relations between them (Saldaña, 2016). Saldaña (2016) suggests dividing codes in the first and second rounds and then looking for emergent patterns called categories. I used the *in vivo* method of coding, a form of qualitative data analysis using the actual spoken words or text of the participants as the data. As I was new

to coding, the process took several attempts. To make sure I understood the coding process, I reviewed Saldaña's (2016) process closely and analyzed examples. After I developed a draft codebook, I consulted with the dissertation coach. She advised me to be aware of simply taking a word out of the transcript selection to use as a code. Instead, I should interpret the words from the first and second rounds of coding to develop emergent categories. I was advised to keep the focus of practice and research questions in mind as I coded. The research questions for this focus of practice are:

1. To what extent do teachers effectively plan to use culturally responsive academic discourse routines during mathematics instruction?
2. To what extent do teachers effectively implement culturally responsive academic discourse routines during mathematics instruction?
3. To what extent did observations and post-observation conversations support teachers to shift their practices to be equitable and culturally responsive?
4. How does the process of engaging African American students in equitable and culturally responsive academic discourse during mathematics instruction support my growth and development as an instructional leader?

During the last three months of the Pre-Cycle, I began by highlighting the transcripts and notes. At first, I entered the code data into tables for each activity, but quickly learned that keeping the data in Google spreadsheets made data entry, color-coding, and organization more coherent. I determined the first and second codes. Some of the data developed a third code and these became the emergent categories. I studied the codes to make sure I was interpreting the information with the research questions in mind. The task was to make meaning of the data as I developed categories (Patton, 2015). After several iterations, I became more comfortable with the coding

process and the emergent categories. After disaggregating the data from the codebook, I could see the areas that the co-practitioner researchers emphasized and used tally marks to quantify the codes from analyzing the CPR discussion data (see Table 8). The Pre-Cycle focused on the CPR members

learning about each other, building trusting relationships, and gathering an understanding of our needs as we focused on teaching conceptual mathematics. The foundation for the CPR work as we move into cycle one has been set from the activities of the PAR Pre-Cycle The information was helpful as I planned agendas and moved into PAR Cycle One. In addition, I gained a deeper understanding and skill in the coding process during this Pre-Cycle.

The implementation of a new district-wide mathematics curriculum was a major component of mathematics instruction for the school year. As a CPR group, we faced the challenge of implementing the conceptual mathematics lessons of the new program as we concurrently developed and implemented lessons that engaged students using academic discourse to ensure they understood the mathematics concepts. The initial data demonstrated that the teachers, who are closest to the work of engaging students, needed collaboration time, manipulatives, and equitable protocols for engaging all students in academic discussion. In the data analysis, I identified three categories that were the foundation for understanding this PAR research: teacher experiences, equitable student engagement, and beliefs about conceptual mathematics.

Teacher Experiences, Practices, and Beliefs

In the PAR Pre-Cycle process, CPR members had time to reflect on their relationships with mathematics and nurture trusting relationships with each other. After careful review and data analysis, I could make these preliminary assertions:

Table 8

Frequency of Emergent Categories

Emergent Categories	Codes	Frequency
Teacher Experiences (25 instances/ 30.5%)	Upper elementary school and beyond, mathematics was a struggle.	12
	Positive experiences	11
Equitable Student Engagement (35 instances/46%)	Necessary for learning math concepts	11
	Equitable academic discourse	6
	Open-ended questions	6
	Calling on strategies	5
	Addressing equity gaps	5
	Racism issues	2
Beliefs about Conceptual Math	Relationship of skills and concepts	3
(18 instances/23.5%)	Teacher feedback	5
	Play-based learning	3
	Manipulatives	5
	Collaboration	2
Total		76

1. Teachers' experiences as students affected how they felt about teaching mathematics.
2. Teachers understood and could identify the processes for engaging students in equitable academic discourse.
3. Teachers had beliefs and knowledge of practices about what might help students in conceptual mathematics.

Whether teachers successfully transferred their knowledge and beliefs to practice was still in question.

Teachers' Experiences as Mathematics Students

Teachers' experiences as mathematics students can impact how they teach. While most shared that they had positive experiences and memories about learning mathematics in early elementary school, four of the five CPR members recalled beginning to struggle with mathematics in the upper elementary school grades and throughout middle and high school; 30.5% of their responses were about positive or negative experiences in math. This impact can be positive or challenging. In terms of positive experiences, they remembered learning through playing and pretending. They recalled loving to count objects, make patterns, and play store with pretend money.

However, as they proceeded through elementary school and the math became more demanding, most CPR members struggled as elementary students. One teacher stated that their teachers never checked to see if the students really understood the concepts but rather continued to cover new material. One member recalled completing homework assignments incorrectly and receiving the papers and tests back with failing grades without any explanation or offer of support. Other members shared a term they had learned describing their math experience: they

had become *math wounded*. Several other members indicated their agreement with the accuracy of that term about their experiences learning mathematics after elementary school.

Some CPR members reported that these experiences in math led to a sense of dread about having to take mathematics courses in college. They expressed that they were fearful before the classes started. However, to their surprise, with the help of the college course professor, study groups, and a better understanding of the mathematics curriculum, some participants shared that they performed better than they expected. One teacher in the group shared that as a student he was a "computation wizard." He loved mathematics and looked forward to problem-solving activities. He fondly recalled some project based mathematics learning activities that made learning fun for him as a student.

As a result of discussing their learning experiences, the CPR members realized that the difference in a positive or negative experiences in math was a direct result of the teacher – the teacher's relationships, expectations, and willingness to ensure learning. They identified the importance of student engagement, modeling, and checking for understanding as teachers, recalling the teachers who lacked in these areas when they reflected on their mathematics journeys as students. According to Knowles (1992), when adults learn, they need a connection to their backgrounds, needs, interests, problems, and concerns. Seeing learning in the context of their life situations by reflecting on their mathematics journey, CPR members were able to consider their own teaching practice. As noted in a study by Ladson-Billings (2009), reorganizing instructional practices that include culturally relevant practices helps students develop necessary skills. Teachers noted that teaching African American students mathematics requires engagement strategies that involve culturally responsive practices which includes academic discourse.

Engaging Students in Equitable Academic Discourse

During our next CPR meetings, teachers discussed what equitable academic discourse during mathematics instruction looked like in their classrooms. In the data, 46% (35 instances) of their responses are connected to key attributes or strategies for equitable engagement. Teachers do know what could and should be a part of their teaching repertoire (Boyd & Markarian, 2011). They reported that they have students engage in think, pair, and share activities with table partners. When working as partners, the students share problem-solving strategies and compare their answers and their work. Teachers reported that they have students write responses on individual whiteboards so they can check for understanding. Some teachers described protocols that they used to ensure all students were given the opportunity to speak.

Teachers shared the differences between equality and equity and had ideas about maintaining equitable discourse in classrooms. Teachers agreed that giving all students an opportunity to speak does not make the conversation equitable (Crawford et al., 1997). Teachers recognized that some students dominated group discussions and that some students never joined the conversations freely but had to be asked questions and purposefully invited into the discussions. They shared that they called on specific students who they knew needed support with problem-solving skills. Teachers agreed that asking open questions such as, "tell us how you solved that problem," gives students the opportunity to share critical thinking skills beyond simply stating the answers. The teachers shared that academic discourse increases when students use manipulatives and work with partners.

During their discussion, I captured data about the strategies teachers learned from each other about methods of engaging students in the problem-solving discussions. One teacher shared how he used a specific protocol—assigning a role for each student in the discussion—

that immersed all students in mathematics discussions. Other teachers were eager to ask more details so they could use the protocol with their students and agreed that some African American students needed to be the focal point of purposeful questions with encouragement.

Teachers shared their understanding about the importance of engaging students in equitable academic conversation, and suggested they were fully aware of what might engage all students in equitable conversations so that the students could better understand math concepts (Boyd & Markarina, 2015). I observed some of these processes in classrooms, but I was curious about how their knowledge and beliefs actually transferred to consistent classroom practices that fully engage all students.

Teachers' Beliefs about Teaching Conceptual Mathematics

The third category emerged from the transcripts of the community learning exchange (CLE) in which teachers were asked, "As we prepare for the new mathematics curriculum, what do you need to successfully teach conceptual mathematics to your students?" Having the teachers respond to this question was important to the research as the process was in accordance with the CLE axioms. CLE axioms refer to conversations and dialogue as being critical for building relationships (Guajardo et al., 2016). The CLE axioms claim that the people, in this case the teachers, are closest to the issues and are best suited to discover answers.

After coding their responses (18 or 23.5%), I identified student engagement strategies that overlapped to a large extent with their beliefs about pedagogical approaches to teaching conceptual mathematics. The data indicated that using manipulatives, assigning real life culturally responsive mathematics tasks, and showing conceptual mathematics videos were useful in becoming stronger teachers of conceptual mathematics. However, the teachers needed time to collaborate and time to engage in professional learning that would boost their skills. They

had ideas about the use of online math programs and games that might engage students in solving meaningful problems that are relevant to their lives. The CPR group thought we might have a math fair in which students could present mathematics projects about mathematical concepts; or we might establish a math week with math facts and problem-solving competitions.

The group thought we could use the PDSA cycle of inquiry to focus on student learning, including designing conceptual mathematics lessons for small intervention groups. During the CLE, the CPR participants shared their beliefs about what they needed in order to teach conceptual mathematics. The ideas and the wish list were essential to encouraging the teachers to think about their critical roles as teachers. Unless they could communicate positive math experiences to students and routinely practice the equitable strategies they identified, these teachers' students might experience the same struggle the teachers reported as they entered upper elementary grades (Peterson & West, 2003). These students would continue to struggle with math unless their teachers shifted their pedagogy (see Figure 8 for a summary of the three emerging categories of the PAR Pre-Cycle). In this cycle, as I was learning about the research process, the teachers and I were forming a group that would question, discuss, and initiate practices that would particularly serve African American students as math learners.

Reflection and Planning

During the PAR Pre-Cycle, I formed the CPR group and began discussions to support the research for the PAR study, collected data from the mathematics journey lines, CPR meetings, the CLE, and reflective memos. As I organized and analyzed the data to determine emergent categories, I looked for patterns that were important to the research questions and supported the overall focus of practice about how teachers can implement equitable and culturally responsive

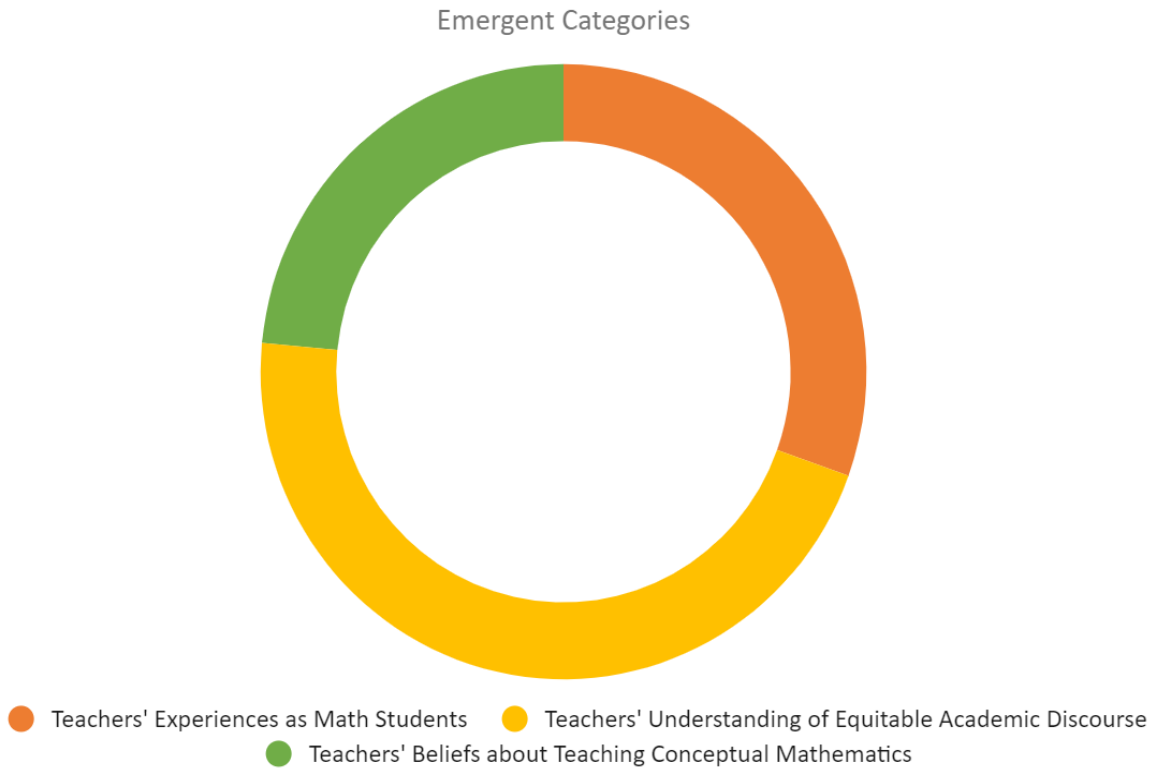


Figure 8. Emergent categories of PAR Pre-Cycle.

academic discourse to support African American students during mathematics instruction. Though the process was initially challenging, I learned to appreciate that the data could be used to leverage action.

As I reflected and analyzed the data and we recognized that the newly district adopted mathematics curriculum included conceptual mathematics lessons, we were encouraged in our efforts. In the new mathematics curriculum, teachers needed to do exactly what we had determined was necessary: engage students in academic discourse to understand the mathematical concepts. As such, teachers would be using manipulatives to support student engagement and understand concepts. In order to be successful with the new curriculum and with the research project, teachers needed to do what they knew was important—ask open-ended, thought provoking questions that guide students to discover problem-solving methods in small group discussions or sharing partners—instead of simply calling on the students who raised their hands. The use of small group academic discussions or discussion partners is a proven method for developing problem solving and critical thinking skills (Zwiers & Crawford, 2011). As a result, the focus for this study shifted from designing conceptual mathematics lessons, which were provided in the new curriculum, to designing questions that would engage students in equitable academic discourse.

As a next step to conclude the PAR Pre-Cycle, I shared the data with the CPR group. As members of the group, they reviewed the data as a part of the PAR process. I collected data from their responses and reflected on their responses. In PAR Cycle One we intended to use the new curriculum and implement conceptual mathematics lessons that engaged African American students. As we shifted towards instruction, the PDSA cycles of inquiry about how students will be engaged in learning conceptual mathematics were the forefront. I was curious about how the

teachers' understandings and beliefs about teaching math transferred to practices that supported more students—especially African American students—in increasing their academic discourse in mathematics (Muijs & Reynolds, 2015).

Reflections on Leadership

As a novice practitioner researcher and veteran site leader in this PAR study, I was grateful for all that I learned. As a school leader, I have grown in my leadership practices. Previously, I led by giving information to teachers during professional development as if I had all of the answers. I created power point slides about what teachers need to know and what they need to do to effectively teach and engage students. However, I have learned that this banking education practice (Freire, 1970) does not transform teaching practice. Rather, engaging teachers in reading articles, asking teachers reflective questions, and giving them the opportunity to engage in dialogue with each other guided teachers to transform as members of the CPR group (Fullan, 2002).

Engaging teachers to recall their mathematics experience as students as they shared their mathematics journey lines was insightful to me as a school leader. As the collected data show, the majority of teachers in the CPR group had negative experiences with upper grade mathematics as students which deepened my understanding of their relationship with mathematics as teachers. I wanted to support teachers as they built engaging mathematics instructional strategies that they could confidently and successfully teach to all of their students.

As equity is at the forefront of this PAR study, building teachers' capacity to identify equitable practices as they focused on meaningful ways to engage African American students was a predominant goal. The Kendi (2019) book study helped us shed light on racist practices that we all need to learn from and bring awareness to as we teach. For example, teachers should

have awareness that African American students can think less of themselves in classrooms as society continues to portray racist ideas in all realms of media about African and African American people. During mathematics instruction, teachers should consider how they frame questions. Teachers should ask more probing questions and allow more wait time as students engage in academic discourse in order to make engagement equitable. As the school leader, I needed to provide more opportunities for discussions regarding racism to continue the growth of the CPR group on this subject to ensure we remain aware of our actions.

As our school district began using a new mathematics curriculum, we used the CLE meeting to ask the teachers what they needed to understand how to teach grade level conceptual mathematics lessons to students. No matter what the curriculum requires, giving teachers agency to name their needs based on their knowledge and experience as teachers was meaningful. As a leader, I have learned that teachers appreciate being able to express their desires and learn from each other in the process as active participants.

My personal goal as I approached PAR Cycle One was to have discipline and consistency with following timelines of the upcoming cycles. I needed to make time daily to code transcripts, plan meetings, make observations, have conversations with teachers, and reflect. These activities should become routine to me as a leader as this study continues. Coding immediately after a meeting may make the comments and context of the discussion easier to recall.

The process of this PAR study had been refreshing as it had given me the opportunity to delve into new ways of leading meetings and engaging teachers in discussions (Bloom, 2005). Beginning each meeting with dynamic mindfulness to bring focus and positive energy into the space has also been a new rewarding experience. Overall, teachers appreciate being able to be co-practitioner researchers as there are no right or wrong answers in this process. We are on a

journey and together we can design conceptual mathematical lessons that will engage African American students as we move to the next cycle. As we used readings to fortify our knowledge and skills, I intended that we could collectively practice and change our practices.

Conclusion

In this PAR study, the process of collecting, organizing, and coding data, primarily based on Saldaña's (2016) methods of qualitative research, led to the development of the categories shared in this chapter. As I coded the data, the focus of practice of this study—how third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American student during mathematics instruction—led to the development of the categories. As a result, we focused our study on examining how teachers implemented culturally responsive academic discourse questions to augment and direct conceptual mathematics lessons.

The PAR Pre-Cycle opened the doors of teacher engagement and trusting relationships for this study. The CPR group bonded as they implemented foundational discussions about reaching the PAR goal as co-practitioner researchers. The mathematics journey line, the CPR meetings with focus questions, the CLE, and reflections provided data that grounded the work of this study. Member checks provided accuracy and quality assurance. This process ensured that I, as the lead researcher, expressed the data in accordance with the CPR group with biases.

As we moved into PAR Cycle One, the CPR group began designing and implementing culturally responsive questions and protocols that engaged African American students in academic discourse. We used the PDSA cycle during our CPR meetings, had coaching conversations, and a CLE, and I continued to use reflective memos and to conduct member checks.

CHAPTER 5: PARTICIPATORY ACTION RESEARCH (PAR) CYCLE ONE

In this chapter of the participatory action research (PAR) project and study, I focused on examining how third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction. According to the California Department of Education School Accountability Report Card, African American students make up the majority of the student population (45%) at the school in this study. As culturally responsive school instructors, our teachers believe in creating learning environments in which they acknowledge, value, and celebrate students' cultures, languages, and life experiences. To improve their practices in enacting their beliefs, five teachers in a co-practitioner researcher (CPR) group engaged in learning about culturally responsive practices as they equitably engaged African American students in academic discourse during mathematics instruction. Teachers focused on the practices of equitable participation and academic rigor to meet the needs of our student population as students engaged in small group, partner, and whole class discussions.

The PAR Pre-Cycle data revealed emergent categories about teachers' experiences, practices, and beliefs that informed the direction we took in PAR Cycle One. When teachers reflected on their prior learning experiences, they recognized the need for implementing different practices for their students, as the majority of the teachers did not recall being engaged as students during mathematics instruction. Teachers recalled being observers of mathematics instruction during middle and high school years as they listened to instruction and independently attempted to solve math problems. As Freire (2018) contends, the banking style of learning does not equip students to learn mathematical concepts or problem-solving skills. As a result, teachers who had learned in that way said that they struggled with higher-level mathematics as they tried

to recall stored information. During their college years, teachers stated that the teaching methods of their college professors offered more student group discourse; as a result, they improved their mathematical understanding. As teachers discussed the impact from these experiences, they explored pedagogical practices that included student engagement in mathematical tasks, small group academic discourse, and collaborative problem-solving activities. As a culturally responsive practice, the pedagogical model of using human dialogue values the students' voices as they learn (Freire, 2018; Hammond, 2015). The majority of the teachers participating in this study evolved as they better understood the value of academic discourse as an effective teaching practice. As I describe the process for the research, the emergent themes reflect their learning and change.

In PAR Cycle One activities, CPR members reflected on their current practices. I conducted observations to collect data on questioning strategies, calling-on processes, equitable engagement in academic discourse, and culturally responsive pedagogy. The overarching question to guide the research was: *How do third through fifth grade teachers* implement *equitable and culturally responsive academic discourse to support African American students during mathematics instruction?* In this chapter, I discuss how I engaged the co-practitioner researcher (CPR) team in professional learning, observations with coaching, peer observations, member checks, and reflective practices. I guided them to recognize how their personal learning experiences and mindsets influenced how they implemented equitable discourse with their African American students during mathematics instruction (see Table 9). As I worked with the CPR group during PAR Cycle One, I collected and analyzed data from the CLE, CPR meetings, coaching conversations, and leadership reflections. I triangulated the data from multiple sources to determine emergent themes. I considered PAR Cycle One as I prepared for PAR Cycle Two.

Table 9

PAR Cycle One CPR Group Activities

Meetings/Timeline	Activities	Data
CPR Meetings August-November 2022	• Dynamic Mindfulness • Personal Narrative • Journey Lines • Jam Board • Charts • Inside/Outside Circles Protocol • Gallery Walk	• Agendas • CPR Artifacts • Notes • Transcripts • Reflective Memos • Charts
Observation and Coaching Conversations August-November 2022	• Observations using Questioning Tool • Observations using Calling-On Tool • Peer Observations • Equitable engagement strategies for African American Students	• Transcripts of Coaching Conversations • Observation notes • Reflections
CLE November 2022	• Dynamic Mindfulness • Video of Culturally Relevant Importance • Whole Group Discussions • Reflections	• Agenda • Jamboard Notes • Reflective Memo

In the first section, I provide an overview of the process and activities in PAR Cycle One. Next, I share evidence and analysis that led to the emergent themes. Then, I describe how I analyzed data that focused on my leadership practice. I relate the process, themes, and reflection including the data collection and analysis to the literature and research questions.

PAR Cycle One Process

To provide a description of the CPR group activities, I share the data collection from the CPR meetings, the CLE, coaching conversations, and reflections. Lastly, I explain how I collected and analyzed the data and how the CPR members engaged in a member check to provide feedback on the data analysis.

Activities

During PAR Cycle One, CPR members met monthly to review culturally responsive practices, recall information from math journey lines, and review the observation tools. I conducted observations and conducted conversations. We reflected on our work in a Community Learning Exchange (CLE). As the CPR members participated in the CPR group meetings, the CLE, and other activities, we focused on answering reflective questions about engaging African American students in academic discourse. After each activity, I wrote reflective memos about the impact the process had on my leadership. I coded the data from these activities and shared the data with the CPR group so they could check and review the data as accountability partners in the process.

CPR Meetings

During PAR Cycle One, the CPR group met monthly. I began our CPR meetings with dynamic mindfulness, an act of being aware of our breath and practicing slow movements to bring awareness to our bodies as we became present and created a gracious space. We reviewed

our school vision and mission to ground us in our long-term goals, meeting norms, and the agendas. Next, we engaged in activities aligned with the focus of practice: engaging African American students in academic discourse during mathematics lessons. We had four CPR meetings during this cycle between August and November.

The goal of the first meeting in Fall 2022 was to set the tone for the school year by focusing on culturally responsive practices. We shared a common understanding that we needed to get to know the students' talents, assets, and interests in addition to their cultural backgrounds as they returned to school at the start of the academic school year (Ladson-Billings, 2009; Hammond, 2015). We agreed to maintain a growth mindset about our students, families, and colleagues. To support this goal, we used an inner circle-outer circle protocol to read and reflect on quotations from *Cultivating Genius* (Muhammad, 2020). Each teacher paired with another teacher and the outer circle teachers rotated. The teachers read the quote and reflected on what it meant for their practice. A partner teacher asked questions to push the readers about their practice. For example, one quote for this discussion was, "History from Black communities tells us that educators don't need to empower youth or give them brilliance or genius. Instead, the power and genius is already within them" (Muhammad, 2020, p. 13). After reading the quotes and using the reflection protocol, the CPR members captured notes on four sets of chart paper (see Figures 9-12) and shared their reflections about how they could create positive and trusting relationships with students. I collected charts as evidence and coded the information.

During the next CPR meeting, I focused on recalling the mathematics journey lines that we created and shared in the Pre-Cycle. The mathematics journey lines connected teachers with their experiences as students learning mathematics. In analyzing those data, I determined that the majority of the CPR members had negative experiences while learning mathematics. One teacher

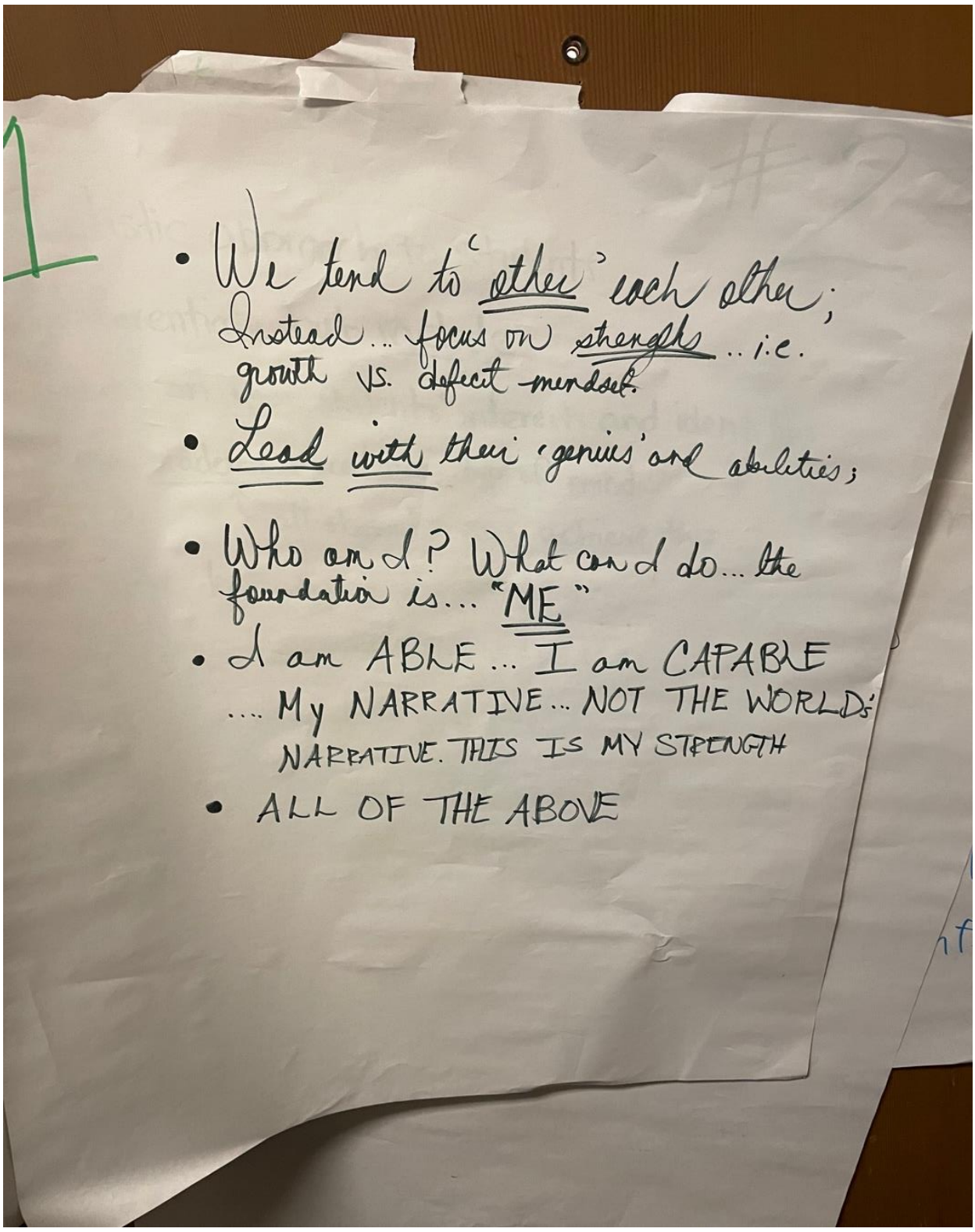


Figure 9. Group One chart notes.

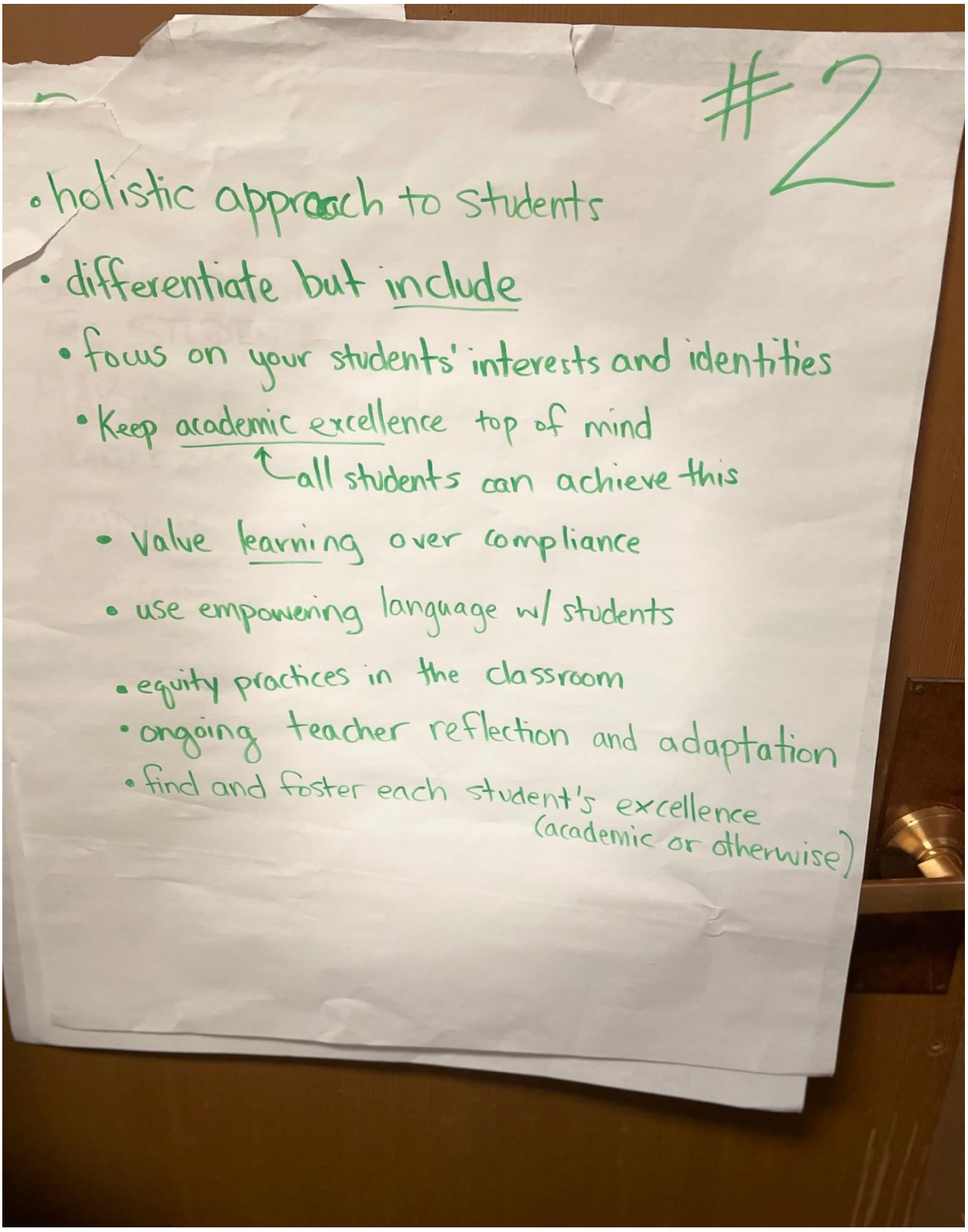


Figure 10. Group Two chart notes.

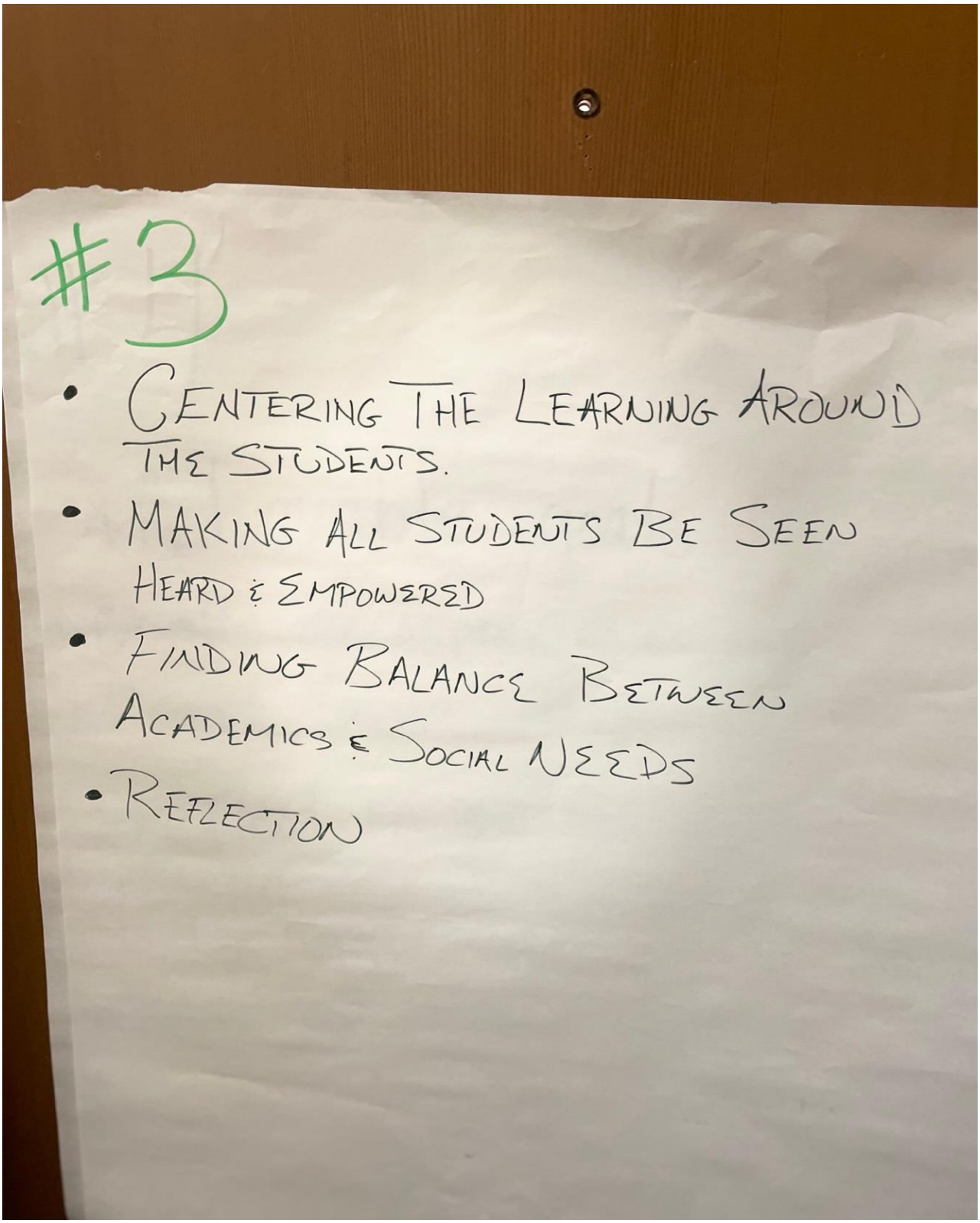


Figure 11. Group Three chart notes.

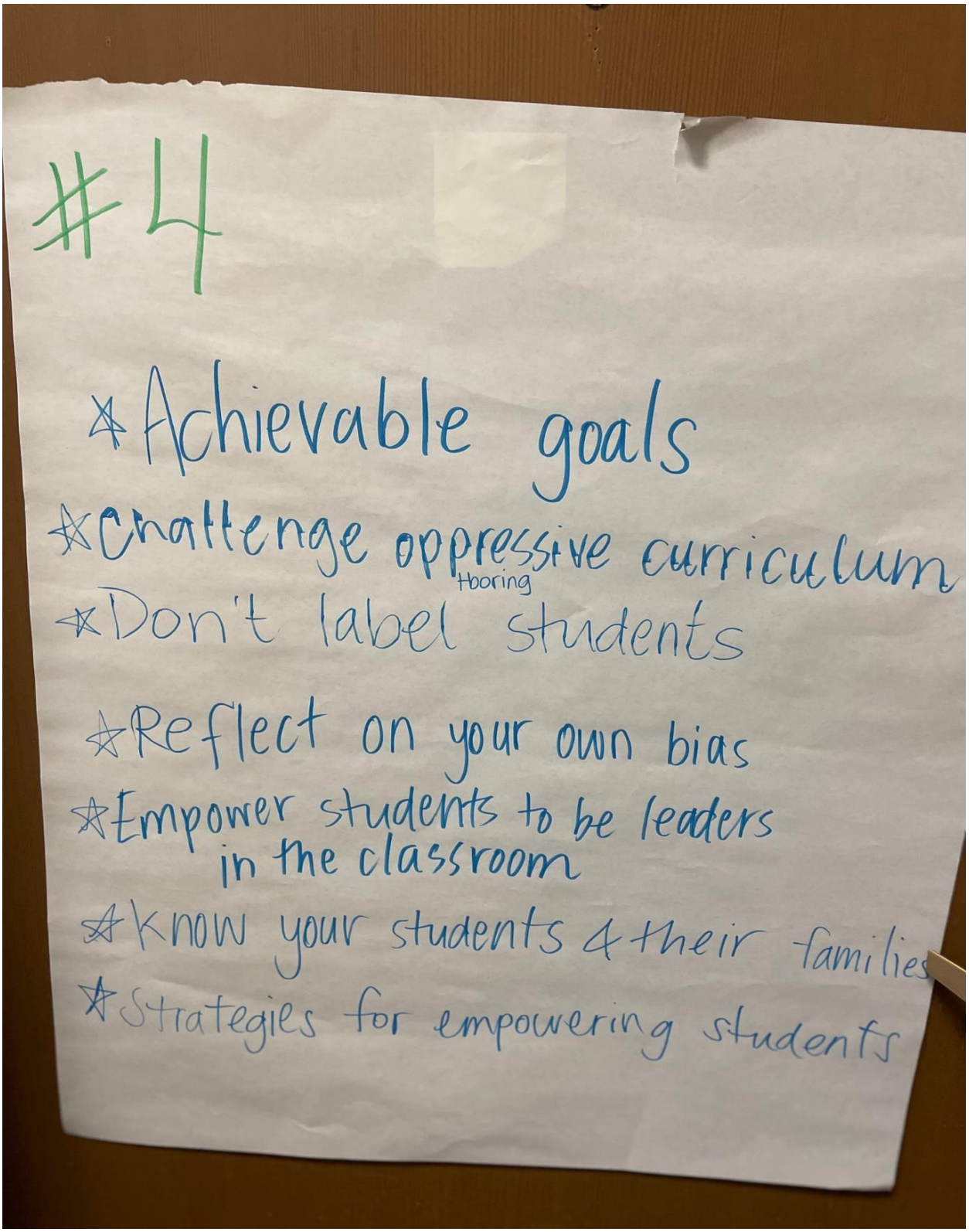


Figure 12. Group Four chart notes.

shared a term he called being “math wounded” (Teacher D, CLE notes, May 18, 2022). As we recalled our math journeys, I asked the CPR group to reflect on the following question, “Based on the reflections of our mathematics journey lines, how do we create classrooms that do not leave our students feeling *math wounded*?” (CPR Meeting Agenda, August 24, 2022). I analyzed the responses from the CPR group, along with all CPR meeting notes, transcripts, and reflections. The teachers agreed that they needed to form trusting relationships with students to create safe environments for students to explore mathematics and learn from errors. Teachers agreed that planning time for learning through academic discourse using protocols and agreements was a structure that they needed as a routine for learning and that they could transfer to students. We discussed how a growth mindset is vital because teachers have to believe and act on the premise that all students—in this case, specifically African American students—could learn mathematics with guidance, engagement, small group instruction, and other mathematical practices, (NCTM, 2014).

During additional CPR meetings, I reintroduced the observation tools to address calling-on and questioning practices (see Appendix E); we agreed to use these protocols during the Pre-Cycle for observations, and I continued to use them in PAR Cycle One. We discussed the format and goals of the coaching conversations. One of the newer teachers requested to see their peers teach; therefore, I included peer observations in the schedule of activities. During our CPR meetings, we discussed the importance of classroom observations as an important aspect of the PAR study.

Classroom Observations and Coaching Conversations

During PAR Cycle One, I made scheduled and unscheduled observations during mathematics instruction. During August, I conducted unscheduled observations (10-20 minutes)

to look for evidence about classroom environments and the implementation of culturally responsive practices, such as the *Hopes and Dreams* family reflections for each student posted in the classrooms, multicultural books in class libraries, and images or artifacts of the students' cultures and interests. I met with teachers following the observations and built trust by engaging in conversations and providing positive responses. In September, I started the next round of observations and included data I collected about student engagement in academic discourse. I connected the observations to culturally responsive practices and looked for positive language and practices that encouraged student participation in academic discourse, including seating arrangements, the use of call and response strategies, and using students' names. I found that, at this time, the majority of the teachers were calling on raised student hands and using whole class discussions as their primary instructional format, effectively excluding many students from the conversations about the mathematics lessons. These observations led to professional development focusing on strategies to engage all students in academic discourse through small group discussions and variations of partner sharing using culturally responsive protocols.

In October 2022, I co-observed classrooms with a dissertation advisor; we observed three teachers, and she engaged one teacher in a post-observation conversation. In Teacher E's classroom, we observed the teacher engage the students in a discussion protocol called *Take a Stand* (Eureka Math, 2021). The teacher projected and posted charts showing two different answers for the same mathematics problem on opposite sides of the classroom. She asked the students to stand by the poster they felt had the correct solution. The students discussed why they chose the particular solution. The teacher then called on students to share the problem-solving methods they used to reach their decision.

After the observation, I engaged the teacher in a coaching conversation about the observed lesson. I informed the teacher that during observations I take selective verbatim or literal notes about the dialogue of the teachers and students. After reading the notes aloud, I complimented the teacher for being bold enough to use the protocol even though she has a talkative group that gets rambunctious. I asked her questions that encouraged reflection about giving students more think-time before engaging in discussions with partners. Specifically I asked, "What would you do differently to better prepare students for academic discussions with their groups?" (Field notes, October 1, 2022). I held additional coaching conversations with the other teachers. The process of observing teachers, taking selective verbatim observation notes, and holding coaching conversations continued during October. In November, I began using codes from the questioning and calling-on tools to capture data about how teachers engaged African American students in academic discourse. We discussed the importance of having assigned small groups, shoulder-to-shoulder or face-to-face partners for think-pair-share (Lyman et al., 2023). We discussed the importance of calling on students with incorrect answers and asking probing questions so all students could feel successful in the learning process. I collected data from the observations and coaching conversations and I shared the data with the CPR members for checking. Next, I coded the data to look for the emergent themes of this study.

Community Learning Exchange (CLE)

On November 16, 2022, I facilitated a Community Learning Exchange (CLE) for the CPR members. The purpose of our meeting was to reflect on the progress, knowledge, and personal growth for ourselves and for our students during PAR Cycle One. Teachers shared how their experiences with the CPR meetings, observations, and coaching conversations supported

their growth in engaging students in academic discourse when learning mathematics. I asked the teachers to reflect on the following three questions:

1. Why is it important to engage students in academic discourse?
2. Are your students learning about mathematical concepts during academic discourse?
3. Have your students' math identities grown since the beginning of the school year and do you know if your students are feeling successful with mathematics?

The teachers answered the questions by using a clock order protocol for an open discussion. All CPR group members participated. I recorded transcripts of their responses as evidence. After three rounds of observations, I tallied the number of times each code appeared in the transcripts. The repetitive codes were checking for understanding, wait time, and using academic discourse as a formative assessment. Based on the evidence, I developed emergent PAR Cycle One themes.

Evidence Collection and Analysis

Throughout PAR Cycle One, I collected and coded data from all activities, including CPR meetings, observations, coaching conversations, CLE, and leadership reflections. I used the *in vivo* coding method (Saldaña, 2016) to identify the first, second, and in some instances, third round of codes. As this is a qualitative coding approach, the passages from transcripts, charts, notes, and other written or oral methods of capturing data were essential to the process of developing themes (see Table 10 and Figure 13).

Emergent Themes

As explained by Saldaña (2016), analyzing qualitative data of text or transcripts led to identifying common patterns or emergent themes that are repeated in the research evidence. During PAR Cycle One, I developed codes that I grouped into categories to determine emerging

Table 10

Emergent Themes with Categories and Code Frequency

Emergent Themes	Categories	Codes
Teachers Implement Questioning Strategies (n=145 or 52.5%))	Probing Questions Facilitate Student Thinking (n=80 or 29%))	• Wait Time (n=37) • Productive Struggle (n=31) • Using Math language? (n=7) • Rigorous Task (n=5)
	Formative Assessment (n=65 or 23.5%)	• Peer-to-peer Discourse (n=25) • Eliciting Student Thinking (n=21) • Conceptual Understanding (n=11) • Academic Vocabulary (n=5) • Use of Protocols (n=3)
Teachers Build Classroom Culture (n=131 or 47.5%))	Culturally Responsive Practices (n=78 or 28%))	• Instructional Practices Through Discourse to Promote Access and Equity (n=34) • Establishing Relational Trust in Mathematics Classes (n=32) • Calling-on Strategies (n=12)
	Honoring Student Differences (n=53 or 19.5%))	• Understanding Student Interest and Cultures (n=21) • Family Engagement (n=9) • Teacher Growth Mindset (n=19) • Building Student Confidence (n=4)

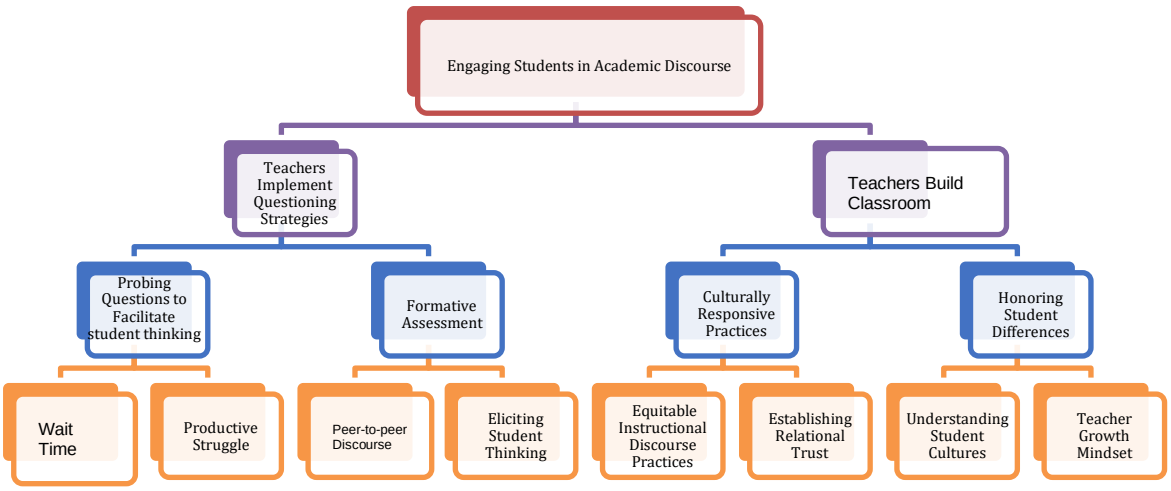


Figure 13. Emergent Themes.

themes for this research study. The data collection and coding led to two emergent themes: Teachers implement questioning strategies, and teachers build classroom culture.

Teachers Implement Questioning Strategies

Questioning supports student academic achievement (Zwiers & Crawford, 2011). When teachers ask students to explain their thinking, the teacher encourages elaboration, clarification, and increased cognitive understanding of skills. From the work of this study, teachers learned how to use effective high level questioning techniques. In this PAR study, I facilitated teacher professional development on asking open-ended questions that required more than yes or no answers. The outcomes of the professional development were to: (a) differentiate between open and closed questioning; (b) understand how open questions and probing questions lead to deeper mathematical thinking and conceptual understanding; (c) understand the types and cognitive levels of questions; and (d) to plan for questioning for an upcoming lesson involving mathematical tasks. Teachers learned how to ask students to explain their thinking and give explanations for their answers and other higher order thinking questions. Students engaged in peer academic discourse as they responded.

After the professional learning, I observed that teachers placed students in small groups or pairs to encourage academic discourse to answer mathematics questions. The teachers used protocols (e.g., round robin or roulette spinners) to determine turns for student talk. Teachers assigned recorders, reporters, and other roles as students answered the questions during peer conversations. The teacher selected a student to be a spokesperson for their group, and other students could agree or respectfully disagree with the problem-solving methods or responses When students struggled to explain their understanding of the concepts or procedures, teachers asked probing questions to stimulate and scaffold their thinking as they provided clues to guide

the students toward the response. Teachers learned to be comfortable with student productive struggle and give students sufficient wait/think time as they redirected or paraphrased questions to help students successfully identify how to solve problems. The teacher asked various types of questions, but probing questions with an allotment of wait time emerged as an important aspect of productive struggle. Two categories included probing questions and formative assessment.

Probing Question Practices to Facilitate Student Thinking

Teachers need to pose purposeful questioning practices and questions to promote student thinking and reasoning skills during mathematics instruction (n=80 instances or 29% of coded data). The questions should be open-ended and should guide the students to discover more information about analyzing, recognizing patterns, and making comparisons as they are using problem-solving strategies to solve mathematics tasks (NCTM, 2014). During this PAR study, observational data indicated that teachers learned to ask probing questions that supported student clarity in their thinking. First, teachers used wait or think time more consistently (n=37 or 13%). Secondly, the teachers promoted productive struggle (n=31 or 11%), including scaffolding, for students, making math language accessible, and designed rigorous tasks.

Improved Wait or Think Time. When teachers ask questions, they should give students the opportunity to think about their responses before responding. Wait time or cognitive processing think time is the act of the teacher pausing after asking a question. The appropriate wait time depends on the level of question and the student. The teacher learns to assess and scaffold for students who may require more time than others before processing the questions and responses. Rowe (1986) describes the appropriate amount of wait time as 3-5 seconds after teachers ask questions and another 3-5 seconds before the teacher responds to the student (see Figure 14). During this time, the student thinks about their response and the teacher should not

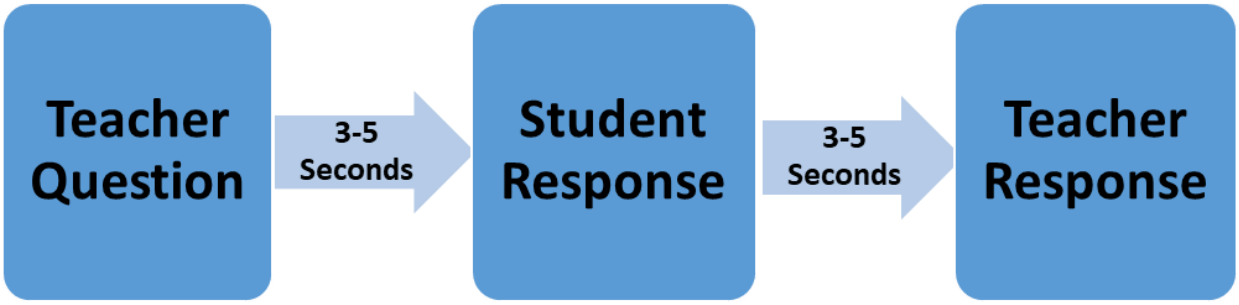


Figure 14. Wait time varies after teacher asks question and before a student responds.

ask other questions or solicit responses. Others state that wait time can be 4 to 7 seconds depending on the level of question (Kagan, 2013; Lyman et al., 2023; Zwiers, 2011). Students offer more thoughtful and contemplative answers, including speculation and alternative answers, when given appropriate wait time. In addition, there is a decrease in students not responding or saying, "I don't know," when time wait is provided.

Increased wait time-affects teacher responses: they may ask fewer questions and focus more on asking clarification, elaboration, or probing questions (Rowe, 1986). The majority of the teachers in this study learned to use appropriate wait time. The teachers replaced basic comprehension questions with higher order questions which helped students make connections, inferences, or comparisons. When students show they are not ready to give responses, the teacher can ask probing questions after wait time. During the observations, I noted that teachers called on students and asked probing questions which supported student understanding of the mathematics concepts. In Cycle One, the CPR group teachers engaged students in the Think-Pair-Share process (Lyman, 1981; Lyman et al., 2023) using wait or think time.

Productive Struggle. Productive struggle is an expended effort to grapple with solving problems or make meaning of challenging ideas (Zwiers & Crawford, 2011). In order for students to engage in productive struggle, teachers need to recognize productive and what is frustrating. Frustrating struggle occurs when students do not have the tools or knowledge to solve a problem and are unable to make progress toward an answer. To actively encourage productive struggle, teachers can apply scaffolding, increased use of math language, and rigorous but accessible tasks. In addition, the teachers can encourage students to use resources in the classroom such as anchor charts, recall prior problems, or to think about what other students may have said. The teacher serves as a mediator of learning so that the student continues to expend

effort. In addition, teachers asked students to draw models (i.e., arrays) to help them understand the mathematical concepts. Probing questions often supported productive struggle in learning mathematics as the students journeyed on the path to understanding the assigned tasks.

Productive struggle requires that teachers give students think time to prepare their responses to share with the class. The CPR teachers paired students with shoulder partners or face partners throughout their lessons. In several classrooms, intentional use of Think-Pair-Share steps—think first, then pair—is a pedagogical best practice that provides students with time to think. When students practice responses with peers, they learn from each other. Another variation of the process that I observed in classrooms was Think-Write-Share, in which students wrote responses before sharing. The process often concluded when the full group came together and students shared their responses or their partner's responses. With Think-Pair-Share or variations, more students responded or joined the discussion.

As teachers used wait time when engaging students in academic discourse, they learned which students needed more time, probing questions, sentence starters, and encouragement. Teachers were sensitive to uncomfortable feelings students had and gave differentiated wait time. Student responses informed teachers about student understanding of mathematical concepts and were used as formative assessments.

Formative Assessment

During PAR Cycle One, as students engaged in academic discourse, teachers asked questions and listened to student responses and used those answers as formative assessments. Using those assessments, teachers were able to modify teaching and learning activities for student achievement (n= 65 or 23.5%). Teachers ascertained during the lesson how well students were learning the mathematical concepts, and they could adjust to spend time with certain

students or clarify a concept that many students found confusing (Venables, 2014). The three key areas of formative assessment included teacher use of peer-to-peer discourse (n=25 or 9% of response), eliciting student thinking (n=21 or 7.5%) and increasing conceptual understanding through academic vocabulary and protocol use (n=19 total or 7%).

During the CLE, teachers shared that engagement in academic peer-to-peer discourse provided students with a marketplace of ideas (n=25 or 9% of response). During mathematics instruction with peer-to-peer discourse, teachers reported that students talked more and were less likely to feel embarrassed about providing an incorrect response with their peers as opposed to with the teacher. Teachers designed peer group discussions by carefully making seating charts and assigning sharing partners and small groups of up to six students. The students began engaging in peer discussions with sentence starters that equipped them with respectful language to disagree or ask for elaboration clarification. The CPR group teachers set the tone for the level of trust among peers. Students worked together to create classroom agreements that included being kind, respectful, and empathetic. Students learned to use respectful language during academic discussions such as saying, "I respectfully disagree with…" whenever they had different problem-solving methods. Students built trusting peer relationships as they started their day with community building activities in the daily morning meetings and closing circles. During each activity, the teacher allocated time for students to acknowledge and appreciate each other. The teachers built positive and trusting peer relationships and ensured students felt safe in contributing to the classroom dialogue (Burbules & Bruce, 2001). The peer-to-peer trusting interactions became vital during academic discourse as students learned from each other. In some instances, the teachers observed that students explained concepts to each other better than the teacher had explained.

As students engaged in academic discourse in small groups or with partners, teachers walked from group to group to listen to the discussions. Teachers asked student groups probing questions to guide them to responses that could justify their thinking, even if their responses were incorrect. Some students began to model the teacher's probing questions to help their classmates learn the mathematical concepts. As teachers asked questions, the students used their problem-solving skills to make sense of and learn the concepts. The CPR group learned to value giving students time for peer-to-peer academic discourse; in turn, the teachers could use the time for observation and formative assessments. As teachers asked probing questions and gave students wait time to elicit thinking and productive struggle, they learned that students could better develop an understanding of mathematics concepts. Teachers believed purposeful questioning could advance and elicit student thinking and learning (see Figure 15).

As teachers implemented questioning strategies, they recognized that probing questions facilitated student thinking when paired with improved wait or think time to allow productive struggle. As a result, students engaged in academic discourse which allowed teachers to check for understanding and use the students' responses as formative assessments. The questioning strategies elicited student thinking. However, in order for students to openly engage in academic discourse, students must feel safe and that the classroom cultures support risk-taking for academic discourse.

Teachers Build Classroom Culture

Teachers need to build a positive classroom culture for implementation of engaging academic discourse (Hammond, 2015); 47.5% of the evidence centered on building classroom culture. Teachers set the tone at the start of the year by welcoming all students, setting up equitable learning practices, and ensuring all students have access to participating in the learning

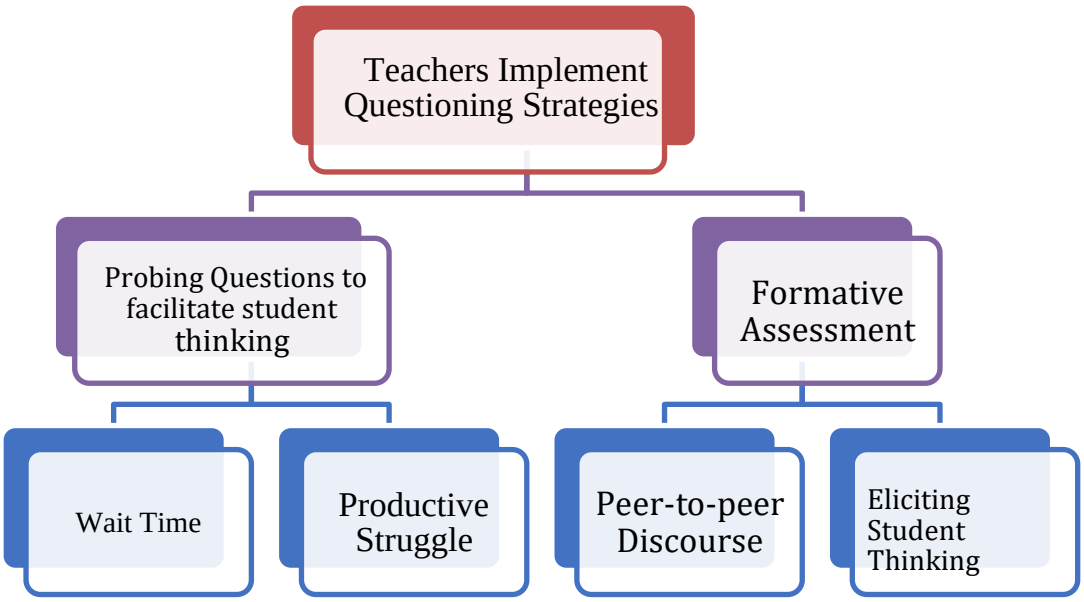


Figure 15. Teacher questioning includes probing questions that facilitate student thinking.

activities. A teacher must strongly believe that all students can learn despite their home, personal, or cultural circumstances; and different approaches are necessary for implementing engagement strategies that give all students access to knowledge. Teachers must have a growth mindset that includes believing that every child can learn (Ladson-Billings, 2009; Muhammad, 2020). In urban school settings, such as the one in this study, students come from a variety of backgrounds. Nevertheless, teachers must believe that a student's background, socio-economic status, or their parents' educational level are not barriers to whether students can learn in their classrooms (Kendi, 2019; Muhammad, 2020). Giving students the opportunity and access to engage in academic discourse requires teachers to understand a student's circumstances and develop a belief in the possibility for each student's success as a part of developing a classroom culture of success.

To achieve this level of parity in the classroom, teachers need to recognize their biases or assumptions. Often, teachers give students from low-income backgrounds fewer opportunities to talk and engage in critical-thinking activities than students of higher-socioeconomic status (Zwiers & Crawford, 2011). Deficit conceptions can shepherd educators into focusing on what students do not have or may not currently be capable of rather than recognizing the many assets and talents that these students have. Teachers sometimes assume low-income students, primarily students of color, do not have problem-solving skills or knowledge to produce the correct answers. African American students, when given insufficient wait time, are often directed to call on other students for help (Delpit, 2012). In fact, students succeed when mechanisms are put in place to support them (Milner et al., 2017). While observing mathematics instruction of CPR group members during the PAR Cycle One, I noted that one of the five teachers did not engage students in academic discourse in small groups or pair shares. The teacher did call on students

while teaching the whole group. The teacher acknowledged that she did not feel comfortable releasing the students to talk. She recalled that the one time she did try it, several students did not participate and some talked off topic. Unfortunately, this teacher was on leave for a portion of the cycle and did not engage in the same professional development or peer observations as other teachers from the CPR group. In another observation, I saw that some teachers were quick to move on to the next student if a student did not respond quickly, and usually those students were African American. During our CPR meetings, we discussed the importance of not giving up on students but intentionally engaging them in productive struggle. We discussed the importance of calling on students who may have an incorrect response and asking them probing questions until they reached an understanding. Nevertheless, some teachers continued to express concern about calling on students who they knew struggled and could not use problem-solving skills, reflecting their belief that some students had limited abilities. These beliefs about students' abilities had to be acknowledged and considered to find a path toward equitable teaching. In PAR Cycle One, the CPR members had the opportunity to reflect about the importance of the views we hold about our students, particularly African American students. As teachers engaged in CPR meetings, coaching conversations, and the CLE, we developed some strategies to address practices that might engage African American learners (see Figure 16).

Culturally Responsive Practices

During August 2022, I focused the PAR Cycle One CPR meeting on culturally responsive practices, and teachers agreed that it was important to learn about their students' interests, talents, and backgrounds, especially at the start of the school year. After reading excerpts from Hammond (2015) and Muhammad (2020), teachers fostered discussion, then listed ideas on chart paper that were essential to making students feel seen, heard, and empowered.

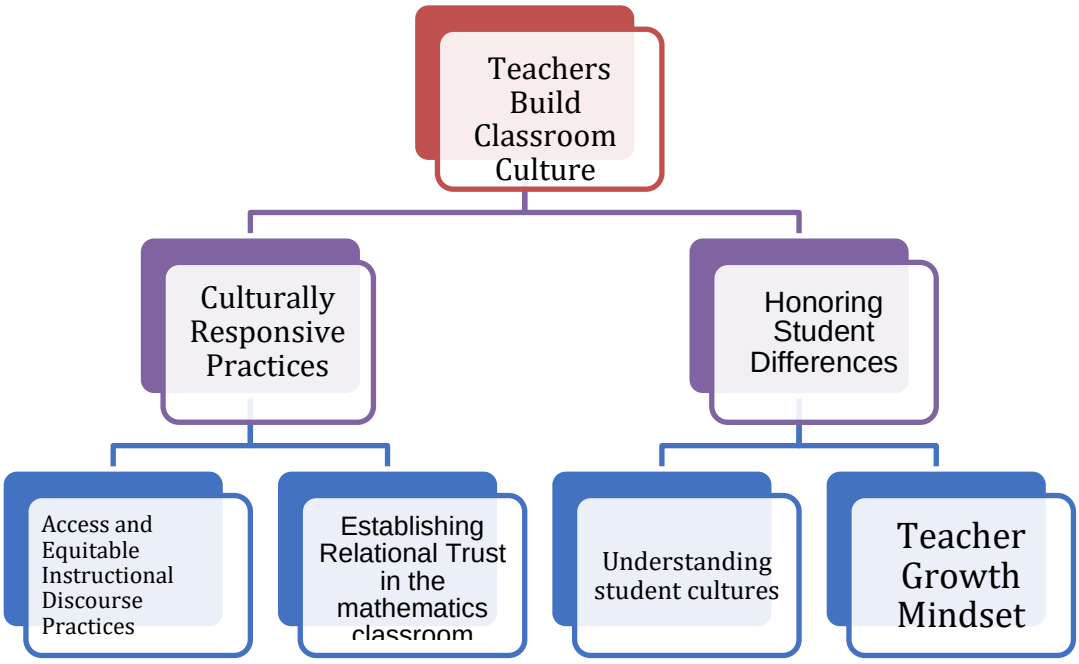


Figure 16. Building classroom culture.

This is an ongoing topic, and we must continue to read and inform ourselves about what, why, and how of culturally responsive practices. Teachers know what to do; they can articulate the rationale for why we use differentiated practices to engage diverse learners, but they do not always fully enact their beliefs. Twenty-eight percent of the evidence concentrated on culturally responsive practices, including strategies for discourse, relational trust, and equitable calling-on.

Strategies for Discourse. Teachers plan how to engage students in academic discourse during mathematics instructions by using effective discourse strategies. Planning and organizing strategies provided more engagement, more equitable participation, and more rigorous opportunities for learning, including Think-Pair-Share (Lyman, 1981; Lyman et al., 2023); and protocols such as chalk talks, gallery walks, and inside/outside circles. Beyond protocols, teachers investigated the importance of anticipating students' solutions, monitoring students work during class assignments, selecting and sequencing calling on students, and connecting students' problem-solving to the underlying mathematics (Stein & Smith, 2018). Ultimately, student engagement in discourse depends on trusting relationships within the classroom culture.

Relational Trust. As we discussed culturally responsive practices during our CPR meetings, teachers realized an overarching component -- trusting relationships. Students need to have trusting relationships with their teachers and peers in order to take risks in mathematics learning. Teachers need to build trusting student-teacher and peer-peer student relationships as they engage students in academic discourse. When students do not trust teachers, or trust other students, they are less willing to share responses or thinking-processes or delve into new learning. Instead, students are likely to keep their thoughts and questions to themselves. Creating an environment in which students feel safe to open up is daunting. The grammar of school culture is strong, and shifting practices is a risk for teachers as they manage change. Teachers'

shifts in practice may take some time; they often try once or twice and give up—often citing poor student behavior (Tyack & Cuban, 1998). Because teacher-student relationships require effective communication, fair expectations, and accountability (Zwiers & Crawford, 2011), we began the school year during PAR Cycle One by emphasizing how to nurture trusting relationships with students and their families. Students shared their interests by completing posters about heritage, their families, their favorite hobbies, and interests. Teachers scheduled small group lunch-bunch time to get to know students. As we agreed to be culturally responsive teachers, we learned that we should not focus on what we do *to* our students but what we do *with* our students (Hammond, 2015). Culturally responsive teaching requires a different type of teacher who builds relationships with students and then fully engages the student in dialogic learning (Resnick, 2015). In order to build real relationships, we had to become comfortable with having conversations about race and culture, starting with acknowledging and examining our own identities and practices (Hammond, 2015; Kendi, 2020). When we shared our cultural histories, including stories of migration to Oakland, we learned about ourselves, our potential geographical and cultural biases, and how to be aware of implicit prejudicial feelings and racist actions (Kendi, 2020). As we nurtured relational trust as a necessary resource of reform (Grubb & Tredway, 2010), then we could have deeper conversations about our instructional practices.

Equitable Calling-on Strategies. When I entered classrooms to observe teachers, I looked for evidence of culturally responsive practices such as equitable discussion protocols or methods of calling on students. I used the calling on tool to record evidence of which students were called on. Teachers reviewed and shared the tool during a previous CPR meeting. Often during mathematics instruction, some African American students were merely observing problem-solving discourse and not participating. After noting the lack of some student

participation, I shared data with targeted teachers; they adjusted how they called on students and worked to create more equitable opportunities for engagement in discussions. They began to use more Think-Pair-Share strategies and engagement protocols. They learned to value calling on students who may be experiencing confusion or difficulty in articulating learning and guided them with probing questions. As students provided responses, the teachers repeated or revoiced the student responses, used the student's name, and observed how student learning shifted when teachers used more equitable engagement strategies to include all students as a culturally responsive practice.

Honoring Student Differences

Teachers agreed to get to know students and their families as a valuable, culturally responsive practice; honoring student differences was 19% of the data. The key factors were understanding student interests and cultures, engaging families, and having a teacher growth mindset so they could build student confidence.

Understanding Student Interests and Cultures. Teachers should know the interests, backgrounds, and cultural values of students and build these aspects into the classroom learning environment. When students believe that teachers respect them and see them as learners, they develop positive relationships with teachers and then can learn more from them (Kervin, 2016). Building trusting relationships is especially important for teachers working with African American students because of the historical biases and the possible prior negative experiences the students may have had in school and society. Teachers continued to show pride and belief in students by displaying their work, giving them praise and feedback, and speaking more intentionally about their interests, cultures, and their academic growth. Including families in the learning process is important as family engagement builds relationships with students.

Family Engagement. Engaging families in student learning is essential for learning about students' cultures. All CPR teachers held family conferences during the first two weeks of school and learned about each student's culture and assets. They asked parents/guardians about the hopes and dreams they had for their children in order to give the family voice and to build relationships and open communication as a supportive, collaborative team. They asked the students about hopes for the school year. The teacher displayed a photo of each student with their hopes and dreams on a classroom or hallway bulletin board, setting the foundation for building a trusting relationship with students. Family engagement extended into the school year with parent conferences, monthly family engagement events, and weekly classroom newsletters. Family engagement supported teachers' positive growth mindset.

Teacher Growth Mindset. Teachers agreed that they would reflect on their biases and focus on having a growth mindset about all students. I reminded teachers of culturally responsive practices throughout the study. The concept of efficacy, which means "to build belief that virtually all children can get smart" (https://www.efficacy.org/about-us), was discussed with the CPR group. Our goal was to eradicate the myth that poor children, primarily children of color, are incapable of learning at high levels. With attention to efficacy, teachers began to develop a growth mindset about how all students can learn no matter their circumstance.

During mathematics instruction, teachers reflected on their math journeys and remembered what helped or hindered their success in mathematics when they were students. Teachers stated the importance of not making students fit the mathematics curriculum but modifying the curriculum and instruction to meet their students' needs and having the mindset that all students can learn. They reflected on the importance of building a classroom culture in which working through mathematics problems to find alternative solutions was empowering to

all students. In our discussions, which they translated to the classroom, they highlighted the critical role of learning from mistakes as a mindset shift that would support taking.

Building Student Confidence. To build student confidence and to honor students' differences, the teachers focused on students' individual strengths and interests; used empowering and encouraging language with students; and used equitable practices in the classroom that differentiate but include all students. For students to take risks and engage in academic discourse, teachers need to establish positive classroom cultures that support student confidence. Teachers build classroom culture through using culturally responsive practices that include establishing relational trust and using equitable instructional discourse practices. Building classroom cultures includes honoring student differences by understanding students' cultures with a growth mindset. As teachers build positive and inclusive classroom cultures they should continue to reflect on how they engage students in academic discourse, as reflection supports teacher learning. Being the lead researcher in this PAR study, I reflected on the emergence of the themes and the process of this PAR cycle.

During PAR Cycle One, I identified two emerging themes: Teachers implement questioning strategies, focusing on probing questions to facilitate student thinking and using questioning as formative assessments; and teachers build classroom culture using culturally responsive practices as they honor student differences. Overall, the themes were identified as common patterns that were repeated in the research evidence and will be considered as I reflect on my role as the lead researcher.

Leadership Reflection and Action Steps for PAR Cycle Two

Reflecting on my leadership during the PAR study was critical. As the leader of the PAR study, my goal for PAR Cycle One was to engage the co-practitioner research (CPR) group in

meaningful conversations that would begin to shift their practices for equitably engaging African American students in academic discourse during mathematics instruction using culturally responsive strategies. I facilitated a set of practices that became a norm for our interactions. Our CPR group participated in dynamic mindfulness and, although this activity was only five minutes or fewer, I recall the relaxing feelings of focusing on breathing and slow body movements as I became present with the CPR group at the start of our meetings. As I reflected on starting meetings with dynamic mindfulness, I appreciated the ECU coaches and leaders for modeling this practice. The CPR group members then took turns leading the dynamic mindfulness practices throughout the cycle. Our intention was that this practice would transfer to classroom use.

After my first CPR meetings in August, I reflected on the data charts that the CPR group created that listed ways to ensure that teachers would implement culturally responsive practices in the classrooms. As I planned for this CPR meeting to start the school year, I was unsure what the outcome would be as talking about race and culture can be challenging. When planning the culturally responsive CPR group meeting, I anticipated uncomfortable discussions, but I let the text (Muhammad, 2020) lead; I was surprised and satisfied at the level of honest sharing and engagement. The culturally responsive agreements that we came to were meaningful. They gave me hope that our school practices would uplift our African American students, empower them, and construct foundations for successful futures. The CPR group members were open minded, positively responsive and committed to learning and implementing culturally responsive practices, and I felt proud to be a part of a caring and committed group.

My reflections about classroom observations and feedback were not as positive as the CPR meeting reflections because my schedule was constantly interrupted. The remaining

difficulties related to the COVID pandemic resulted in many teacher absences, and I had to cover classrooms or attend to other urgent matters. However, observing classrooms was vitally important to the PAR study; as a result of regular observations and conversations, some teachers shifted their practice. I clearly saw growth in the ways in which teachers equitably engaged students. Some teachers shifted from only calling on raised hand, to usually engaging students in *turn and talk*, Think-Pair-Share, Think-Write-Share, or small group discussions about mathematical concepts. Some teachers increased their skill in this area after participating in peer observations. My time-restricted ability to make observations and engage in coaching conversations made it difficult to see this shift in all CPR groups members; therefore, my personal goal for PAR Cycle Two was to commit fully to these observations as a critical element of this study.

The Community Learning Exchange (CLE) provided important evidence about the PAR process. Teachers were given time to reflect and engage in discussions about the PAR study and listen as the CPR group members made meaning and emerged as the experts (Morales, 2015). As the teachers are the closest to the work, they are best equipped to inform others about their needs and the needs of their students (Guajardo et al., 2016). As I analyzed data from the CLE, I reflected and questioned whether I asked the participants the correct questions:

- Why is it important to engage students in academic discourse?
- Are your students learning about mathematical concepts during academic discourse?
- Have your students' math identities grown since the beginning of the school year, and do you know if your students are feeling successful with mathematics?

As I collected and coded data, I had to focus on what the evidence actually said in relation to the PAR overarching question and sub questions: The overarching research questions guiding the

PAR study was: *How do third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction?* The four sub questions were:

1. To what extent do teachers effectively plan to use culturally responsive academic discourse routines during mathematics instruction?
2. To what extent do teachers effectively implement culturally responsive academic discourse routines during mathematics instruction?
3. To what extent did observations and post-observation conversations support teachers to shift their practices to be equitable and culturally responsive?
4. How does the process of engaging African American students in equitable and culturally responsive academic discourse during mathematics instruction support my growth and development as an instructional leader?

The CPR group member responses led to trends and patterns. As our district adopted a new mathematics curriculum this year, teachers came together to study and plan lessons. I observed them working together to decide which questions from the teachers' manual were most important to student learning. After implementing the first few lessons, we knew that the quantity of questions, lessons in the teachers' guides, and pacing needed to be tailored to fit the needs of their students. As the administrator, I empowered the teachers to use their expertise and discretion to adjust the pacing and amount of questions as long as students were being taught the major grade level standards with positive results. I initially had some doubt that this decision was the correct leadership move. However, later in the school year, the district leaders confirmed my decisions by communicating the same message to teachers.

As I prepared for PAR Cycle Two, I focused on improvements that I needed to make as the leader of the PAR study. For example, although I find coding a difficult process, I found I was more fluent if I coded the data immediately after the activities. Therefore, as I moved forward to PAR Cycle Two, I planned to code immediately after activities, observe more often, and write reflections.

Conclusion

For PAR Cycle Two, I continued with monthly CPR meetings, teacher observations with coaching conversations, leadership reflections, and a CLE. As the lead CPR group member, I needed to differentiate the support for one teacher, who has excellent classroom management skills and trusting relations with his students; however, he needed to implement the grade level standards as opposed to activities of personal interest. He had students working in cooperative groups, but the questions and assignments were not focused on the grade level standards. As PAR Cycle Two approached, I planned the questions that I would ask during the CLE:

1. How do you collaborate with other teachers to design questions for mathematics instruction or how do you decide which questions from the instruction manual you will ask your students?
2. What are the most important types of questions you ask students during mathematics instruction and how do you track student responses?
3. How do you equitably engage all students in academic discourse during mathematics instruction?

While PAR Cycle Two is the end of this formal process and study, the changes in teacher practices must continue. Engaging students in academic discourse is a valuable practice across the curriculum, and we plan to continue peer observations.

CHAPTER 6: PAR CYCLE TWO AND FINDINGS

In this participatory action research (PAR) project and study, I focused on examining *how third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction.* I analyzed data from previous cycles to generate emergent themes and guide the study. In PAR Cycle One, two themes emerged: teachers implemented questioning strategies, and teachers built classroom culture. I utilized the emerging themes from PAR Cycle One and Two to inform and determine two findings.

1. Teachers changed their academic discourse routines to foster equitable access.
2. Observations and post-observation conversations facilitated by the school leader supported teachers to shift to culturally responsive practices.

Teachers became more conscious of their academic discourse routines for promoting equitable engagement of African American students and changed their routines to engage more students. Secondly, I learned to conduct evidence-based observations and have more effective conversations to support the teachers to shift their practices. In this chapter, I review the PAR Cycle Two process which included activities, data collection and analysis, emerging themes, and reflection on my leadership practice. I relate the data collection and analysis to the literature and research questions.

PAR Cycle Two Process and Analysis

PAR Cycle Two activities (January-May 2023) included CPR meetings, teacher observations, coaching conversations, a community learning exchange (CLE), and reflections (see Table 11). The CPR group met monthly, and I observed and facilitated a conversation with each teacher of the CPR group two or three times. Teachers completed one round of peer

Table 11

Chart of PAR Cycle Two Activities and Data

Type of Interaction	Activities	Data Collected
CPR Meetings Jan-May 2023	● Dynamic Mindfulness ● Personal Narrative ● Protocols	● Agenda ● Field Notes ● Transcripts ● Charts ● Reflective Memo
Observations and Coaching Conversations Jan-May 2023	● Observations using Questioning Tool ● Observations using Calling On Tool ● Peer Observations ● Equitable Engagement Strategies	● Selective Verbatim ● Field Notes ● Reflective Memo
CLE May 17, 2023	● Dynamic Mindfulness ● Personal Narrative ● Protocol ● Reflections	● Agenda ● Field Notes ● Charts ● Transcript ● Reflective Memo

observations. All CPR members participated in a community learning exchange (CLE). All CPR group members participated in dynamic mindfulness, personal narratives, protocols, and reflections during the meetings. All our activities centered on the focus of practice: engaging African American students in academic discourse during mathematics instruction.

Activities

I began PAR Cycle Two by observing the CPR members' mathematics lessons and facilitating coaching conversations about the observations. During the PAR Pre-Cycle and PAR Cycle One, teachers in the CPR group had participated in professional development regarding questioning and the importance of academic discussions during mathematics instruction. We discussed that I would record evidence using the questioning tool and calling on tool using selective verbatim during the observations. After the observations, I met with each teacher individually, and we reviewed the data that showed the types of questions they asked their students and which students were called on. Most teachers asked their students open-ended questions that allowed for academic discourse and had established systems for students to talk with partners or small groups. Some teachers used equity sticks to call on a few students after the small group or partner discussions. However, two of the five teachers engaged solely in whole group discussions and only called on students who raised their hands to answer teacher questions while the other students listened. Based on the findings, I supported these two teachers during the coaching conversations by leading them to set goals for immersing students in discussions and coached them to rearrange student desks to make the classrooms conducive to holding regular small group or partner discussions. One teacher requested to observe peers, so a peer observation schedule was created and implemented.

As the lead researcher, I attended the peer observations and conducted coaching conversations post-observation with the observing teacher. Coaching questions led the teachers to reflect and set goals for more student discussions and less teacher talk during mathematics instruction. I observed one teacher, per their request, for three consecutive days during mathematics instruction and held coaching conversations after each observation. I observed shifts in their routines that led to more student academic discourse, which included prepared questioning, discussion protocols, and student think time. The teacher shared they had taken more time to plan for academic discourse by carefully selecting questions and student discourse protocols. They expressed that they learned more about students' understanding or lack of understanding about the mathematical concepts from listening to the students' responses than from their workbook answers. One CPR member shared a shift in routines with the other CPR members and expressed appreciation for them by allowing peer observations.

During PAR Cycle Two, I facilitated monthly CPR meetings. As requested during PAR Cycle One, our CPR group continued learning about the importance of culturally relevant teaching practices. We watched videos of Emdin (2016) calling on educators to examine their essential roles to impact lives of students of color who are challenged to succeed in an education system that does not address their needs. We discussed the necessary *armor*, or self-protections, we give students for hopes of academic success without knowing the students and what armor or tools they actually need. We discussed the reality pedagogy of urban educators who must continue to build relationships with students as we continue to get to know the interests, assets, culture, and needs (Hammond, 2015). The CPR group concluded that giving students voice in the classroom through academic discussions and listening to them with intentionality was

essential to learning and integral to culturally relevant practices. We held a staff community learning exchange (CLE) to discuss our pedagogical needs for ensuring quality academic discourse to support student learning.

The CPR group and I held the final CLE on May 17, 2023. All teachers in the school participated. The essential questions we examined during the CLE were:

1. How do you decide which questions to ask students during mathematics instructions?
2. What are the most important types of questions for students during mathematics instruction and how do you track student responses?
3. How do you equitably engage all students in academic discourse during mathematics instruction?

I facilitated the CLE by reading the questions to the teachers, having time to write responses on large post it notes, and asking them to share responses on questions charts (see Figures 17, 18, & 19). In a gallery walk, teachers read responses and used check marks to indicate responses that resonated with them. The teachers discussed responses and trends they observed from the responses to each question. As the lead researcher, I listened to the responses and took field notes. During the CLE, the staff shared their journeys with engaging students in academic discourse during mathematics instruction and how they valued the shifts they made this year. Teachers stated their intentions for carrying the pedagogical practices of engagement in academic discourse with a deliberate focus on process in their instructional routines.

Analysis of PAR Cycle Two Data

I coded and analyzed PAR Cycle Two data which led to confirming these emerging themes: (a) academic discourse during mathematics instruction evolves as an instructional routine; and (b) evidence-based coaching conversations led to changes in teacher practice. The

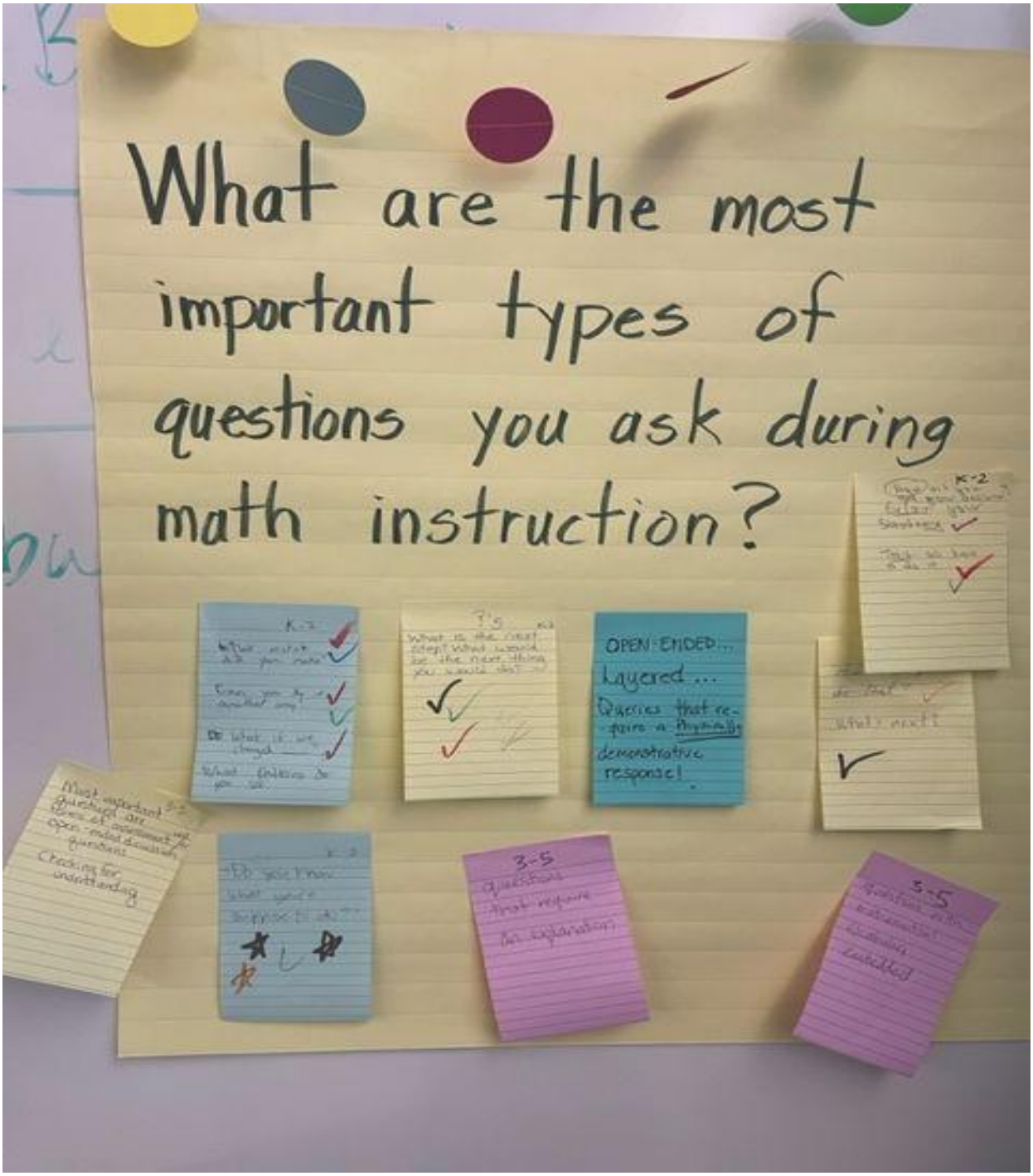


Figure 17. CLE Questions and Responses: What are the most important types of questions you ask during math instruction?

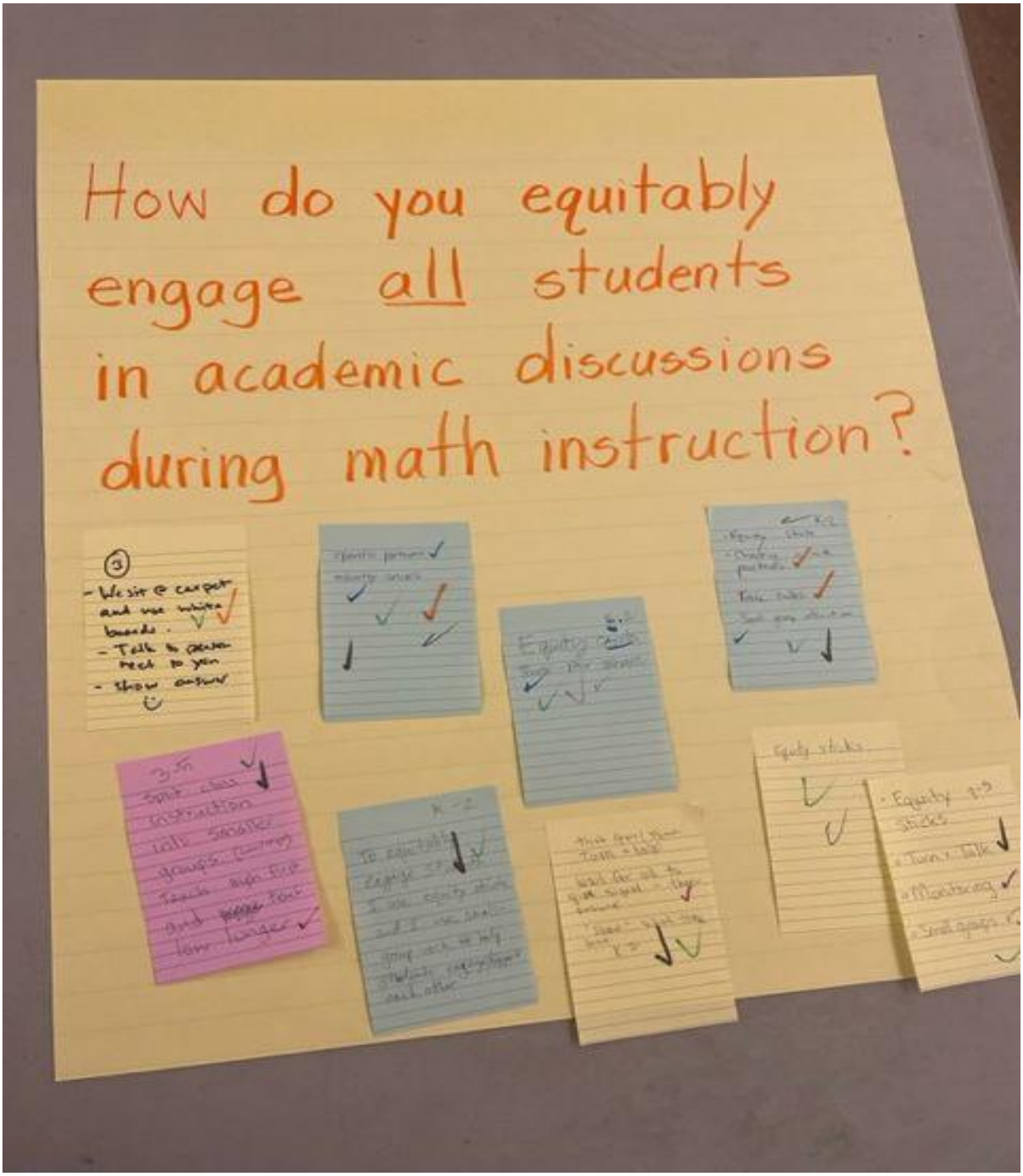


Figure 18. CLE Questions and Responses: How do you equitably engage all students in academic discourse during mathematics instruction?

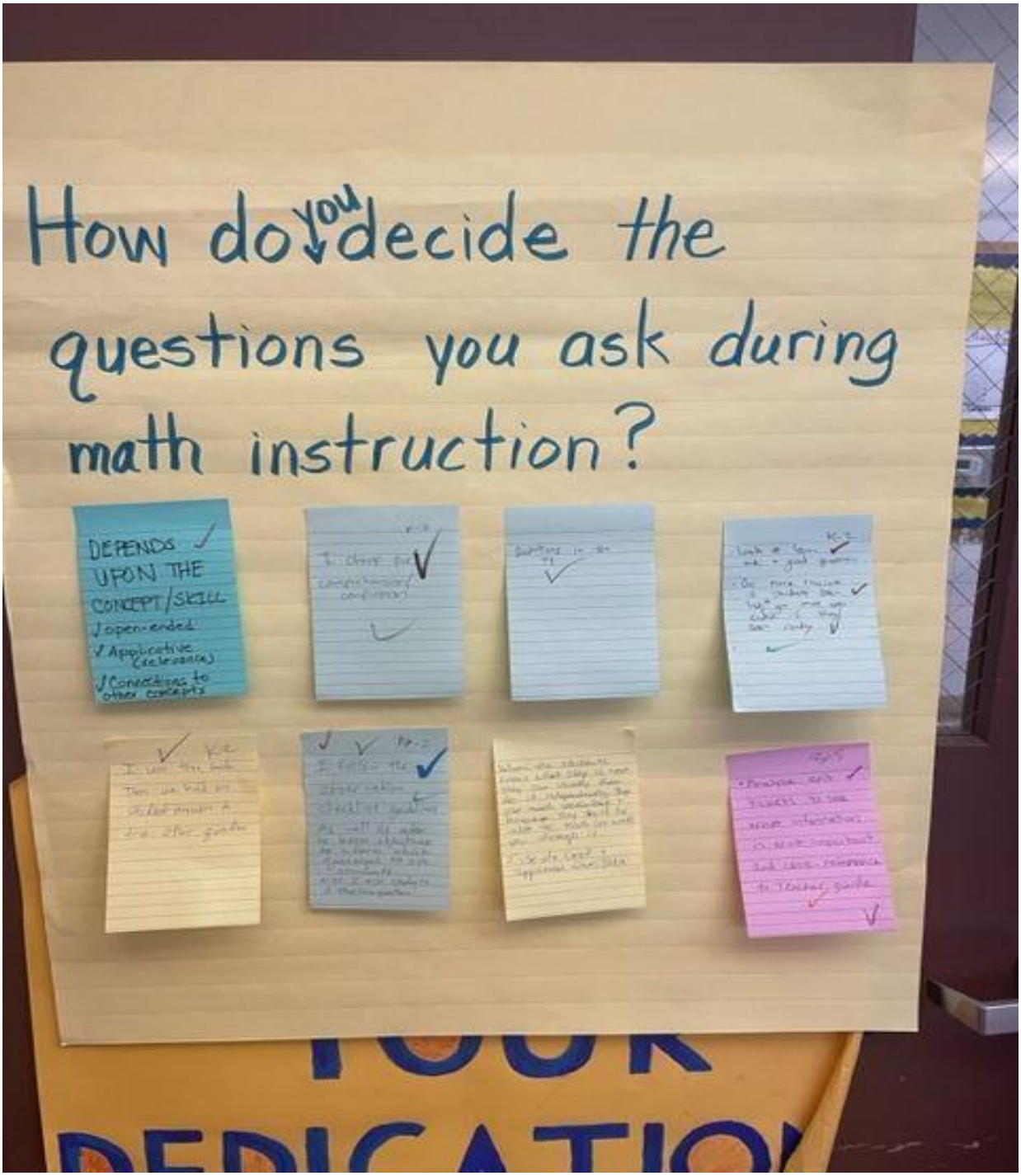


Figure 19. CLE Questions and Responses: How do you decide the questions you ask during mathematics instruction?

PAR Pre-Cycle and PAR Cycle One data influenced the determination of these emerging themes. Teachers were more aware of the importance of academic discussions during mathematics instruction, which included acknowledging the necessary shifts in their practices.

During PAR Cycle Two, I determined the first theme as teachers used academic discourse during mathematics instruction, which evolved as an instructional routine. The CPR group recognized the importance of creating classroom cultures conducive to trusting and respectful engagement in academic discourse. They viewed academic discourse routines as critical for culturally responsive teaching practice to "make space for student voice and agency and build a classroom culture around communal (sociocultural) talk and task structures" (Hammond, 2015, p. 17). As the teachers developed different questioning strategies, the data from the CPR group meetings, CLE, and field notes aligned with the pedagogical shifts (see Table 12). The CPR group shared that, by participating in this study, they implemented student engagement in academic discourse during mathematics instruction a part of their daily instructional routines, including arranging classroom desks for small group and partner discussions and use of paired and full group discussion strategies that fostered more equitable access (53% of responses). The CPR group shared that they spent more planning time developing questions that engaged students in academic discourse during mathematics instruction (see Figure 20). The teachers planned formative assessment questions and used exit tickets to determine student learning; as a result, diverse student voices were a larger part of the daily routines for academic discourse (46% of responses), which was a shift in their routine that led to the first theme for PAR Cycle Two (see Figure 20).

The evidence that led to the second theme in PAR Cycle Two magnified the importance of the school leader's coaching and participation in the process as an essential component of

Table 12

PAR Cycle Two: Emerging Themes

Emerging Themes	Categories	Codes
Academic discourse evolves as an instructional routine (n= 220)	• Daily learning centered on student engagement in academic discourse (n= 117 or 53.5%)	• Small group discussions (n=45) • Think-Pair-Share (n=40) • Equity Sticks (n=21) • Use of protocols (n=11)
	• Teachers plan questions for engaging students (n=103 or 46.5%)	• Planned Formative Assessment questions (n=40) • Planned Exit Tickets for small group discussion (n=32) • Empowering student voice with planned questions (n=31)
Evidence-based coaching conversations led to change in teacher practice (n= 66)	• Evidence from Calling on and questioning tool supported coaching conversations (n= 43 or 65.7%)	• Teachers asked open more ended questions (n=30) • Equitable Engagement protocols (n=5)
Total n=286 instances	• Wait time increased with probing questions (n=23 or 34.3%)	• Productive struggle by asking probing questions and increasing wait time(n=20) • Teacher growth mindset about student ability (n= 3)

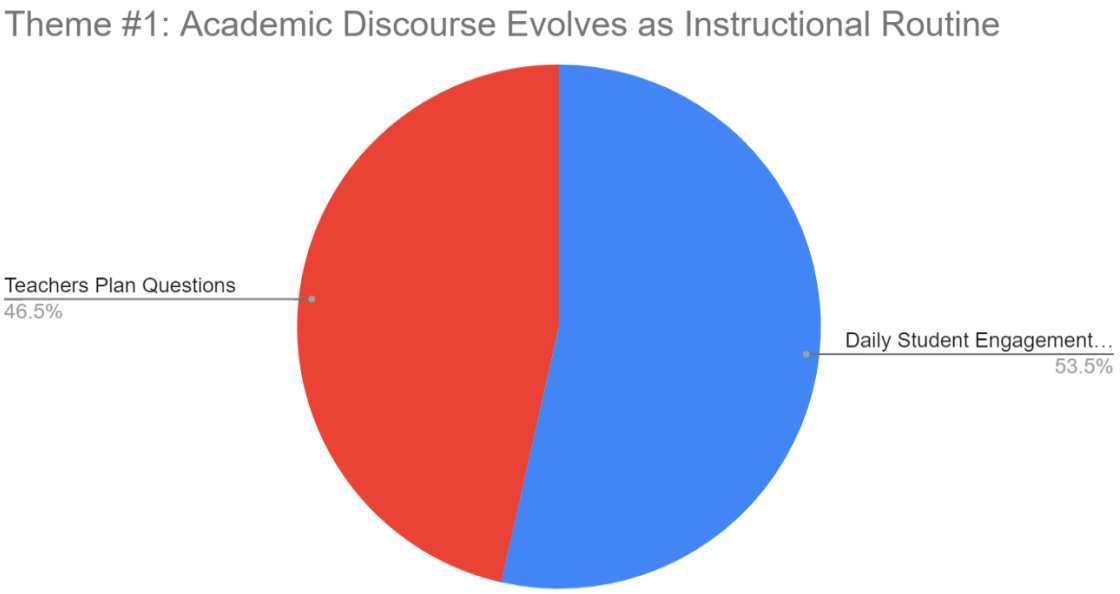


Figure 20. PAR Cycle Two: Evidence-based categories led to confirming emerging themes**.**

shifting teacher practice (65% of responses; see Figure 21). The coaching conversations urged teachers to plan and implement sufficient wait/think time and ask probing questions (34% of the data; see Figure 21). In PAR Cycle Two, I increased coaching conversations; administrative support was important for their shifts in practice. Teachers appreciated and benefited from coaching, and they acknowledged that experiences in the CLE, meetings, and coaching conversations supported them in their learning. Teacher experience in learning and practicing new academic discourse routines in their professional learning is critical if they are to change their classroom practices. As the lead researcher, I conducted observations and post-observation conversations immediately after the observations during PAR Cycle Two. The evidence I shared during our coaching conversations guided teacher reflection about pedagogy and routines. Teachers shifted from asking yes/no questions to asking questions that generated thoughtful responses using problem solving and critical thinking skills. Teachers acknowledged the importance of asking open-ended questions and questions that propelled students towards understanding. In particular, teachers credited the conversations as the impetus needed for them to shift their practices related to wait or think time. During the last rounds of observations and coaching conversations, I commended teachers for asking more probing questions and giving more wait time for students to think and ponder responses. Teachers expressed gratitude for coaching and deemed our conversations supportive.

As the school year progressed, I made unscheduled classroom visits and saw evidence of student engagement in academic discourse in other subjects in addition to mathematics. Teachers used small group discussions and partner discussions as regular classroom routines. Students developed the habits they needed to engage in dialogue with peers, and they discussed the questions with minimal off-topic conversations. The emerging themes of academic discourse

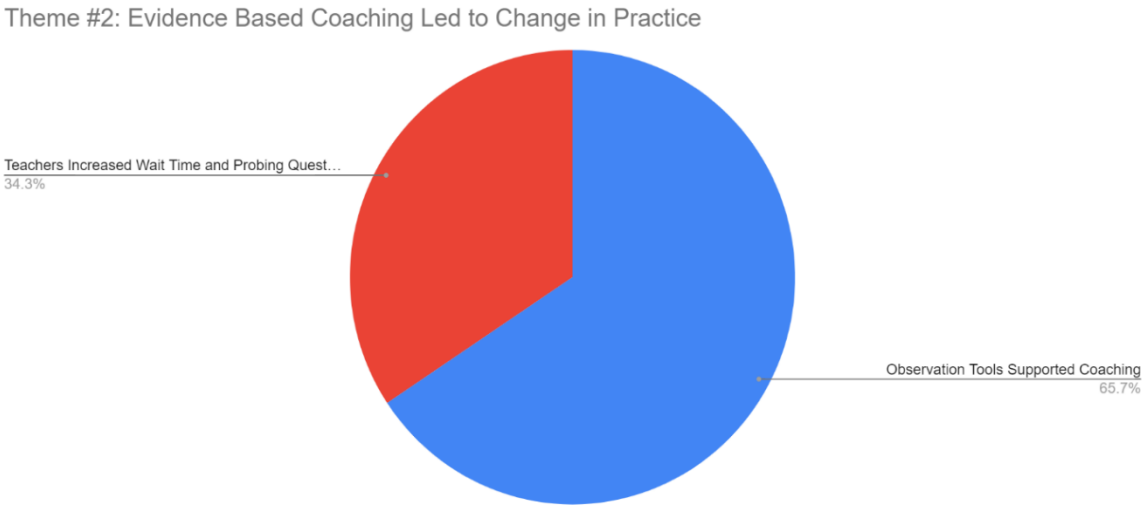


Figure 21. PAR Cycle Two evidence-based categories led to confirming emerging themes.

routines, particularly question strategies, and teacher planning, which included attention to classroom culture in PAR Cycle One, developed more as attention to student learning in PAR Cycle Two. The coaching support during the evidence-based coaching conversations led to the changes in the teacher practice that emerged as our second theme in PAR Cycle Two.

During our PAR Cycle Two CPR meetings, the CPR group worked together as a professional learning community to plan lessons. They reviewed the teachers' manuals and pacing guides and selected the best questions from them to engage students in academic discourse. After teaching lessons, the CPR group reassembled to discuss questioning strategies as well as the assets and challenges of the process. The group shared student exit tickets and ideas about reteaching lessons, including questions that promoted learning for students who displayed a need for additional support. Through self-reflection during the CPR meetings, the teachers developed awareness of their practices and identified classroom routines and structures that needed shifting.; For example, teachers recognized that academic discourse was effectively eliminated by assigning individual workbook pages for the students to complete in silence. One teacher who participated in peer observations expanded their participation in the CPR group discussions and continued to plan questioning with small group academic discourse.

However, despite the learning as a group, teacher readiness for shifts varied; one teacher still engaged her students in whole group discussions. She expressed that the effects of virtual learning during the pandemic continued to be evident; several of her students did not engage in discussions and would sit quietly unless she facilitated. She reflected on her practice, saying she could have applied more effort and that she needed to reduce her amount of teacher talk, and that she appreciated the feedback in this area. Overall, four of the five teachers in the CPR group expressed the benefits and advantages of engaging students in academic discourse and reflected

on learning from participation. The evidence from all PAR Cycles led to the findings of the overall PAR study.

Findings

The majority of the teachers participating the PAR study developed academic discourse routines that led to shifts in their practices during mathematics instruction. The regular evidence-based observations coupled with post-observation coaching conversations that I conducted supported teacher shifts in practice. Teachers participated in meaningful discussions in the CPR meetings and implemented culturally responsive practices. Because of the evidence collected in the PAR Pre-Cycle, PAR Cycle One, and PAR Cycle Two, I determined two findings:

1. Teachers changed their academic discourse routines to foster equitable access.
2. Observations and post-observation conversations facilitated by the school leader supported teachers to shift to culturally responsive practices.

I support each finding based on the evidence collected from three cycles of inquiry.

Teacher Shift toward Academic Discourse

Teacher pedagogical shifts required teachers to change their instructional academic discourse routines. Pedagogy refers to teaching methods both in theory and in practice (Dewey, 1938; Freire, 2018). Educators' beliefs influence pedagogical choices and involve the interplay between culture and different ways to learn (Freire, 2018; Nachmanovitch, 1990). Teacher pedagogy influences their daily practices and routines. However, while teachers may express beliefs about student access and rigor, they often employ daily academic discourse routines that do not in fact match their expressed pedagogical choices and do not support student learning. Therefore, teachers need professional learning to shift those routines. In this PAR study, teachers changed their instructional practices to include academic discourse routines—first obvious in

math instruction and then apparent in other subjects. These shifts occurred in two primary areas: shifts in instructional routines that would foster student dialogue and participation and shifts in questioning data from three cycles represents 66% of the total study data.

Shifts in Instructional Routines

Over the course of this PAR study, teachers developed several strategies for academic discourse that they used daily. From the PAR Pre-Cycle to PAR Cycle Two, as shown in Figure 22, the frequency of data for engaging students in academic discourse as a daily routine increased from 55 instances to 220 instances. First, teachers redesigned the classrooms to promote more student dialogue. Teachers placed students' desks in small groups and found that engaging students in academic discourse during assignments as a daily routine occurred easily with the desk rearrangement. Teachers consistently used culturally responsive participation routines—movement, equity sticks, small discussion groups, partner share, and protocols— and these instructional routines became familiar to students.

Small Groups or Partners. Teachers moved students' desks out of the traditional rows into clusters of five or six with students facing each other to make academic discussions naturally engaging. The teachers designed the groups with norms about collaboration such as sharing airtime, listening to others, speaking up, respectfully disagreeing, and appreciating the contributions of others. In addition to creating small groups, teachers assigned partner sharing variations of Think-Pair-Share (Lyman et al., 2023). Some teachers created partner groupings such as shoulder-shoulder partners, face-to-face partners, or partnerships that required students' movement. Whether small groups or partner groups, evidence from the PAR Cycle Two revealed daily student engagement in academic discourse during mathematics instruction.

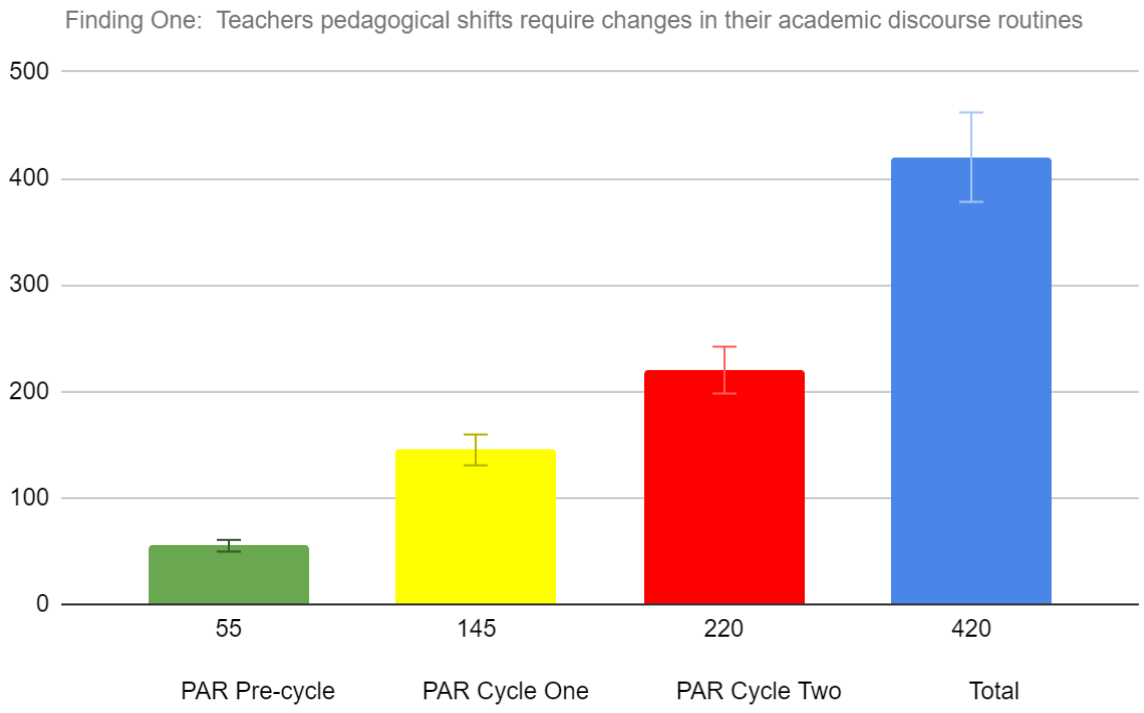


Figure 22. Data from three cycles of inquiry for finding one.

By PAR Cycle Two, teachers rotated student groups monthly to give students the opportunity to engage with different students. Students became familiar with the process of engaging in academic discourse, and the students remained on topic with discourse enriched with problem solving, critical thinking, and peer learning opportunities. Student engagement in academic discourse became a daily routine that teachers included in their lesson plans for mathematics instruction.

Routines for Participation. During the PAR Pre-Cycle, the teachers called on students who raised their hands the majority of the time. By PAR Cycle Two, teachers had nearly stopped calling on hands. Instead, they engaged students in academic discussions in small groups or pairs. They used equity sticks, popsicle sticks with student names, and teachers used them by selecting an equity stick at random to call on students. After allowing students to engage in academic discourse through small groups or with partners with sufficient time to discuss their ideas, teachers called on individual students to share group findings. The random selection is designed to fully engage students so they are prepared to speak if called on. Observation data provided evidence showing some teachers assigned student groups specific tasks that rotated to different students throughout the week, such as facilitator, reader, materials gatherer, scribe/note taker, presenter, and process checker. As students worked in the small groups, the presenter would practice what they would say to the whole class on behalf of the group. In some instances, the student presenter invited other group members to add additional information.

Teachers used a variety of culturally responsive protocols to engage students in academic discourse. Although data show that small group discussions (45 instances), partner sharing (40 instances), and equity sticks (21 instances) are the preferred methods of engaging students in academic discourse, teachers also used movement protocols such as take a stand, chalk talk, and

inside/outside circle protocols (11 instances) to engage students in academic discourse. Culturally responsive protocols take more planning time and teachers avoided elaborate protocols when they introduced new mathematics concepts or started new units of study. Whether teachers used small groups, partners, called on students by use of equity sticks, or through protocols, teachers engaged students in academic discussions daily during mathematics instruction, which was a shift in their practice that required planning.

Daily student engagement in academic discourse during mathematics instruction evolved to become an instructional routine for four out of the five teachers involved in the PAR study. However, teacher change toward making academic discourse a routine required significant effort. Teachers had long been accustomed to assigning workbook pages and calling on hands as key instructional practices. Teacher training programs in our district taught direct instruction methods using teacher example followed by guided practice and independent practice and then lesson closure. The direct instruction method was not intentionally designed to reduce student discourse; nevertheless, the overall effects resulted in limited student discourse to support student learning. Thus, the teachers had to shift their questioning routines to counter this result.

Questioning Routines

As the CPR group learned the importance of equitably engaging all students in opportunities to exchange thoughts and answer questions in small group discussions, they had to change their questioning practices. They could articulate the importance of higher order questions that required analysis, but their questioning did not always match their beliefs. In addition, at the start of PAR Cycle One, our district adopted a new district wide mathematics curriculum that offered listings of problem solving and assessment questions to the teachers. Teachers read the mathematics instructional manuals and selected the best questions to meet the

learning needs of their students. Teachers asked formative assessment questions more often. To make academic discourse more equitable, they began to be more intentional about their questions. Teachers planned their questions and created scaffolds such as anchor charts and desk placards with sentence starters to encourage student participation in the small group discussions.

Teacher question form and level of cognitive demand of questions is a critical skill for teachers. Most often teachers do not plan questions and, thus, frequently ask questions with low cognitive demand. If teachers plan questions for engaging students in academic discourse during mathematics instruction, they are more likely to ask higher-level questions that push student thinking. Over the three cycles, I met regularly with the CPR group to share information with teachers about the importance of asking students questions that require problem solving and critical thinking skills. In the PAR Pre-Cycle, I engaged teachers in professional development about questioning. The teachers then could distinguish between open and closed questions, understand how open and probing questions lead to deeper mathematical thinking and conceptual understanding, and plan questions for an upcoming mathematics task lessons. Questions that stimulated mathematical thinking and questions that assessed student learning are included in Table 13.

When teachers who formed small groups or student partners, they were more intentional about asking questions that promoted academic discourse between or among students during mathematics instruction on a daily basis. For example, during PAR Cycle One, Teacher D called on students individually and asked questions for white board responses such as:

> How many lines did you count? What is the answer? What is the magic number? What kind of angle is this? If a pizza has 12 slices and I take 2 slices, what is the fraction?

During PAR Cycle Two, Teacher D no longer called on hands and no longer asked closed

Table 13

Professional Development on Types of Questions

Types of Questions	Examples
Questions to Stimulate Mathematic Thinking or Probing Questions	What is same/different about…? What pattern(s) do you observe? What comes next and why? What are you trying to figure out right now? How can you record what you are thinking or seeing?
Assessment Questions	What did you discover? How did you find that out? What made you think that? What made you decide to try it that way? How do numbers show up in your drawing?

questions that required specific or yes/no answers. He shifted his practice to plan questions that were open-ended and required explanations and a display of problem skills such as:

> How can you show me that the answer I provided is correct or incorrect? Are there any other ways to solve this problem? Work with your group and come to a consensus about the best way to solve this problem? Explain. (Teacher D., Observation, March 14, 2023)

In this study, teachers began to change their daily instructional routines to emphasize academic discourse that was intended to include more students. After participation in regular monthly CPR meetings, CLE sessions, reflections, observations and conversations, and evidence from three cycles of inquiry, most teachers shifted questioning planning, question form, and implementation. As a result, teachers began to plan for and use formative assessments.

Formative Assessments

As teachers engaged students in collaborative academic discourse, they developed formative assessment tools for groups and individuals, including exit tickets and individual white boards. Exit tickets are formative assessments given at the end of a lesson that inform the teachers of the students' understanding of the lesson. For example, teachers gave small groups pre-planned assessments to solve in groups. After the students worked together in small groups, the teachers gave students individual exit tickets that the teachers collected. Teachers used the data from the exit tickets to identify which small groups required additional lessons.

Teachers employed the use of individual white boards to determine student understanding, particularly for visuals, problem-solving steps, or re-teach concepts. Teachers asked students probing questions and guided their responses to help with conceptual understanding. Teachers encouraged the students to ask questions and honestly communicate whether they understood the mathematic problems or needed more support.

At the beginning of this study, evidence from the PAR Pre-Cycle indicated that teachers called on only a few students to answer questions; therefore, only those few students engaged in academic discourse with the teacher. Most other students observed the discourse exchange, and some students ignored the lesson. Teachers most often called on students to speak when they raised their hands, leaving most students out of the conversations. In some instances, teachers called on students by using equity sticks, but teachers did not typically use wait or think time and gave students the option to pass and not participate in answering questions. Choosing to pass or simply not answering the teacher's questions was especially true for African American students during mathematics instruction. By the end of the study, the teachers were using different instructional routines and planning questioning and formative assessments.

During PAR Cycle Two teachers demonstrated a shift from asking closed questions to planning and asking open-ended rigorous questions that required the use of mathematics vocabulary and problem solving strategies. Teachers developed an understanding that they needed to plan the questions that would empower student voice in the classroom. Thus, students had opportunities to share their problem solving skills as they learned to critically think about the mathematics problems as they discussed the problems. Many of these shifts occurred because of the observations and post-observation conversations I had with the teachers. As of PAR Cycle One, I increased the frequency of the observations and conversations and used the data for individual conversations, teacher choices about what to change, and for planning the CPR meetings.

Observations and Conversations: Teacher Shift to Culturally Responsive Practices

Data from three cycles indicate that the school leader must be a companion on the journey of shifting teacher practice to incorporate the lens for culturally responsive practices

(n=204 or 33% of total data for the study; see Figure 23). The Grissom et al. (2021) meta study determined that an effective instructional leader "engages in instructionally focused interactions with teachers" (p. xiv). As the school leader, I was the lead researcher of CPR group in the study and collected data through evidence-based observations and conversations which comports with Grissom advice that school leaders should be "facilitating productive collaboration and professional learning communities" (Grissom et al., 2021, p xiv). Thus, I facilitated CLE meetings using the culturally responsive processes that I wanted teachers to use in their classrooms; teachers must experience the methods in professional learning that we want them to use in classrooms. Secondly, I collected data on the types of questions teachers asked students using the questioning tool, how they called on students using the calling on tool, and how they engaged students, particularly African American students, in equitable academic discourse.

By the end of PAR Cycle Two, evidence supported that most teachers had shifted their instructional academic discourse routines based on pedagogical theory and practice to support equitable teaching and learning which, in turn, supported culturally responsive practices that more fully engaged African American learners. Allen and Boykin (1992) established that more conversation in the classroom with peers or small groups is conducive to learning— particularly for African American students. Stereotype threat—an assumption that students of color, particularly African American students, will be less capable in academics—deters student success. To counter this outcome, teachers can concentrate on access and rigor, especially in mathematics classrooms, to provide students of color an equitable path to engage in discussion (Boykin & Noguera, 2011). I use the framing of cultural responsiveness presented by Hammond (2015) and key precepts from the Ready for Rigor Framework that were evident in the study, to develop questions that we considered in PAR Cycle Two.

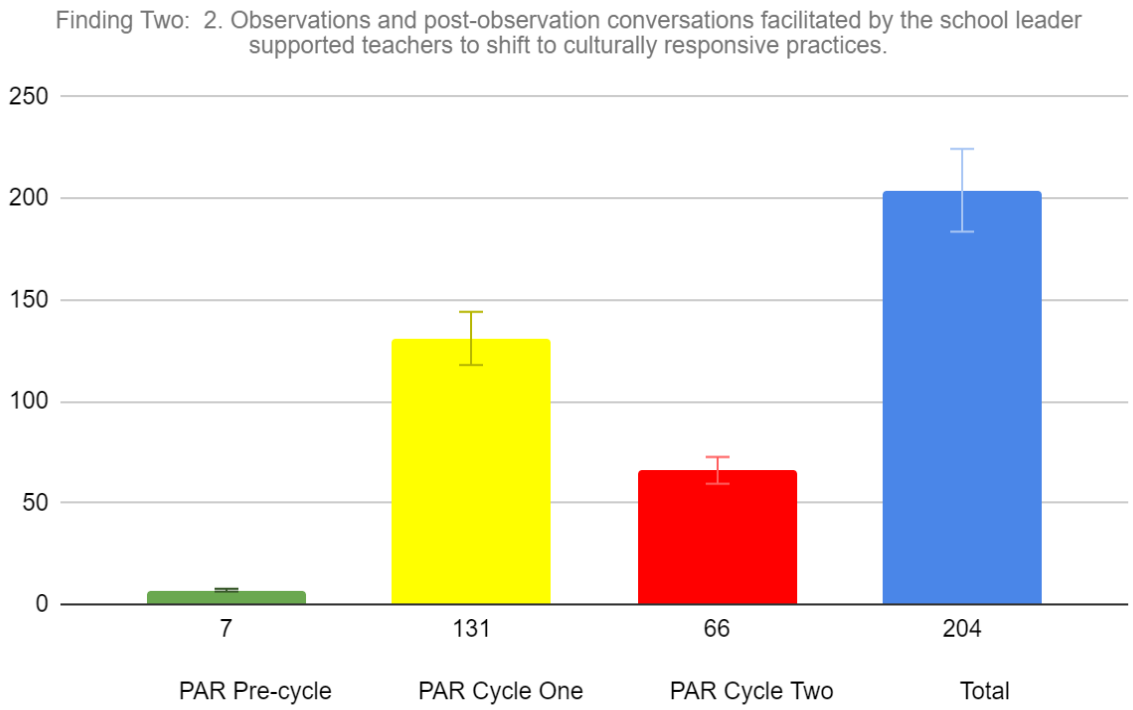


Figure 23. Data from three cycles of inquiry for finding two.

1. Awareness: How do we shift from individualism to collective responsibility for learning in the classroom?
2. Learning Partnerships: How do teachers partner with students to engage in students in taking responsibility for learning?
3. Information Processing: How do teachers provide authentic opportunities to process learning and increase intellectual capacity through using cognitive routines and formative assessments?
4. Community of Learning: How do teachers build an intellectually safe space for learning by developing classroom routines that promote socio-cultural talk and task structures?

As a result, three key processes helped teachers individually and collectively as the CPR group invested in collaborative professional learning: Evidence-based observations, post-observation conversations, and teacher experiences in professional learning.

Evidence-based Observations

Observing teachers was a priority during the PAR study. Although the scheduling challenges of being a school leader were further exacerbated by the needs of the Covid pandemic, I prioritized the activities in the PAR study to include multiple classroom observations followed by immediate evidence-based coaching conversations. I used selected verbatim field notes that I coded based on the calling-on and questioning observation tools, and I shared data with teachers and determined if teachers knew the assets and interests of the students in their classrooms.

During PAR Cycle One, I observed classroom teachers and collected data about how teachers implemented questioning strategies and how they built classroom culture with culturally

responsive practice. Specifically, during PAR Cycle One I looked for images that reflected the race and ethnicity of the student population. I looked for evidence of the students' interests such as their Hopes and Dreams assignments, All About Me posters, and books in the classroom libraries. During PAR Cycle Two, the focus of the observations was on academic discourse as well as on culturally responsive instructional routines. For example, I collected data about how and when teachers used wait or think time, which teachers used these strategies more than others, and which teachers choose to ask more probing questions. The number of observations and coaching conversations varied based on the needs of the teachers and their availability. I completed scheduled observations and coaching conversations with three of the five teachers twice during PAR Cycle One and twice during PAR Cycle Two. I completed two or more unscheduled walk-through observations and sent teachers emails noting highlights about questioning strategies and student engagement in academic discourse. For example, I observed one teacher of the CPR group four times during PAR Cycle One and six times during PAR Cycle Two followed by evidence-based coaching conversations. He began teaching at our school just prior to the PAR Pre-Cycle. Early evidence that I gathered from the first set of observations indicated that the teacher was not following the grade level curriculum and was teaching topics of his interest. In addition, he primarily used cold calling to ask students to explain their problem solving skills. However, if students struggled with responses, he did ask probing questions to lead students to understand the mathematics. Thus, the majority of the academic discourse was between one student and the teacher. The selective verbatim field notes revealed that the teacher did the majority of the talking during all of the PAR Cycle One observations. At the end of PAR Cycle One, we arranged for this teacher to schedule peer observations of two other CPR group teachers. I accompanied him during the peer observations, took selective verbatim notes, and

used the data during coaching conversations after the peer observations. He immediately began planning questions, using exit tickets, and assigning mathematical tasks that engaged students in academic discourse via small groups. He learned the interests of his students and included their interests in his discussions. He began using the district curriculum that allowed him to participate more fully in the CPR group discussions.

Thus, I determined that the observation tools helped teachers individually to change practices and peer observations as well as our discussions helped the teachers to collaborate more on ideas about shifting practices. I am hoping that teachers learn to use observation tools with each other, and that teachers from the CPR group will model for other teachers in the school.

Post-Observation Conversations

During coaching conversations after the observations, I used a collaborative approach to the conversation using data from the observation, and I used coaching techniques to remind teachers to ask more probing questions and anticipate mistakes from students (Stein & Smith, 2018). I began each coaching conversation with a greeting and reviewed the purpose and the format of the conversation. I reminded the teachers that the purpose of our discussion would be to review the data collected from the observation tools that they agreed to use in this PAR study. I provided the teachers with a copy of the observation tool with the data I collected during the observation.

In the coaching conversations and in CPR meetings, we examined the data from the questioning tool, the calling on tool, and other selective verbatim notes. I asked teachers questions that invoked reflection about the contents of the data such as equity of student voice during academic discourse, asking more open-ended and probing questions, and overcoming the uncomfortable seconds of silence while waiting for student responses. The teachers identified

which practices they needed to change and often began planning for those changes during the conversation. Over the progression of the PAR cycles, four of the five teachers noted an increase in asking more questions that were open-ended and probing. Teachers gained patience and valued the importance of giving students more wait time for productive struggle as applied problem-solving skills. Teachers engaged students in academic discourse during mathematics instruction in small groups or pairs as part of their daily instructional routine.

During the conversations, I did not provide direct feedback; instead, I guided teachers to think about how to monitor the small group discussions to look for common misunderstandings that could be addressed to the whole group. As a result, planning questions and engaging students in academic discourse became routines for teachers involved in the PAR study. As teachers began to value academic discourse as an equitable engagement strategy, they made academic discourse a part of their instructional routines. The changes in their instructional routines were a result of their shifts in pedagogical theory and practice about teaching and learning. The evidence-based coaching conversations that I had with the teachers in this PAR study led to changes in teacher practice, and the CPR meetings were occasions for our collaborative conversations, learning, and planning.

However, despite our best intentions, I did not always have success and had to adapt my work to the readiness of the teacher. During PAR Cycle One, at the start of the school year, one teacher of the CPR group expressed concern that her students were entering the grade level with extremely low academic and social skills due to the educational challenges of the pandemic. She did not believe her students had effective social skills to engage in academic discussion in small groups or with partners. Evidence-based observations showed that she regularly had her students sit around the perimeter of the classroom floor rug with white boards. She posed questions that

asked students to solve mathematics problems or draw representations such as arrays on the white boards as an engagement strategy. She called on students by hand to explain their responses or drawings and allowed them to call on another classmate if they were unable to offer explanations; however, she did not probe students who had difficulty responding or return to them to check for their understanding. Unfortunately, the teacher had an extended absence during part of PAR Cycle One and again during PAR Cycle Two and was unable to attend half of CPR group meetings. Because of her absences, I was unable to make consistent observations or provide coaching. At the end of PAR Cycle Two, at the end of the school year, I made a final observation of the teacher. The students sat at their desks in a semi-circle. The teacher was leading a discussion and calling on students by hand. At one point in the lesson, the students expressed excitement, raised their hands and even began blurting out responses, a perfect opportunity for partner sharing. During our coaching conversation, I shared evidence with selective verbatim about the observation and this missed opportunity for all students to engage in academic discourse. I asked the teacher if she ever tried to engage the students in small groups or academic discourse. She responded by saying,

> I tried turning and talking to partners at the carpet, but they never learned to sit at the carpet and pay attention. So many kids never say anything. They try to coast by and never say they don't understand. They often sit mute, but maybe it was for me not trying more. I also need to work on less teacher talk. (LD, post-observation, May 25, 2023)

However, based on the evidence of the change in teacher practice from the other CPR group members, I inferred that this teacher perhaps would have been able to make shifts in their pedagogy with more opportunities for observations and evidence-based coaching conversations. Although the PAR study is ending, I plan to use observations followed by evidence-based

coaching conversations, peer observations, and other strategies to support this teacher to develop culturally responsive practices. My goal will be to work with her as a companion to shift her instructional practice. However, four of the five teachers showed marked improvement, and we will continue to build our collective capacity as we share our learning with other teachers in the school.

Evidence from activities in the three PAR cycles indicates that teachers valued my role as the school leader who became a companion on the journey to changing practices and considered it an important aspect of this PAR study. During a CLE meeting on May 16, 2023, teachers expressed appreciation. One teacher stated, "I appreciate the principal feedback during the coaching conversations because it does not seem judgmental. It is really a time to reflect about how do I improve as a teacher." Another teacher indicated that the coaching conversations pointed out that he was calling on students by hands more than he realized; the evidence led him to change this practice. Teachers noted the importance of coaching conversations during the CPR meetings and CLE as leading to the shifts in their practice. The overall data provided evidence that as the school leader, my role in the PAR study was important and I had to be a companion on the teachers' journeys of change. Part of the reason that we could change, however, was that teachers had solid experiences in professional learning.

Teacher Experiences in Professional Learning

During the PAR study, the professional learning sessions were an important adjunct and another way for me to shift teacher practices to include academic discourse as a daily routine. Grissom et al. (2021) determined that effective instructional leaders facilitate "productive collaboration and professional learning communities [by using] strategies that promote teachers working together authentically with systems of support to improve their practice and enhance

student learning" (p. xiv). Teacher learning needs to be a model for student learning and, to be authentic, I needed to use the same attributes of cultural responsiveness I stressed for students in teacher learning. I used the Hammond (2015) framework to organize our professional learning to ensure collective and equitable participation of CPR members.

I engaged teachers in book studies on culturally relevant practices and teacher beliefs. We read excepts and used protocols such as the Inner-Outer Circle and the Golden Line to discuss and identify our biases, efficacy principles, and cultivating the genius in every child (Kendi, 2019; Muhammad, 2020). As we learned about the need for the brain to work in collaboration with others (Hammond, 2015), we made agreements about using academic discourse practices such as Think-Pair-Share (Lyman,1981; Lyman et al., 2023) to give our students the opportunity to engage with each other. We reviewed academic discourse protocols and examined the importance of planning questions that would build student problem solving and critical thinking skills.

The professional learning on questioning supported teachers to identify key practices (Stein & Smith, 2018) such as monitoring discussions, selecting students to present what they discussed, anticipating errors, and sequencing questions from least challenging to more challenging depending on the tasks. During our CLEs, teachers reflected on what they accomplished with student engagement in academic discourse. One teacher who had been hesitant to fully engage students was invited to do a peer observation and came away ready to change their practice due to the level of student engagement they observed in the colleague's class. After each professional learning, I gave teachers time to plan questions and protocols as they collaborated and shared ideas. Further, I observed teachers to see if they implemented what they planned. I collected evidence and shared the observation evidence during coaching sessions.

From the data about coaching conversations from PAR Cycle One (n=131 or 64%) and PAR Cycle Two (n=66 or 32%) I infer that evidence-based coaching observations and conversations supported by the CPR meetings that I facilitated supported teachers as they changed practices to be more culturally responsive. Four of the five teachers in the CPR group made substantive changes in their instructional practices by incorporating equitable academic discourse practices into their daily routines and shifting practices to address the culturally responsive strategies of collective learning through teacher-student and student-student partnerships, instructional routines, and cognitive push that Hammond (2015) describes as tenets of cultural responsiveness.

Conclusion

In this chapter of the PAR study, I explained details about the PAR Cycle Two activities, emergent themes, and findings. The evidence demonstrated how teacher pedagogical shifts became daily instructional academic discourse routines with student engagement in academic discourse. Through use of small group discussions, think-pair-share, equity sticks, and other discourse protocols, four of the five teachers in the study began to engage students in academic discourse to solve problems with peers on a daily basis. They created classroom culture based on culturally responsive practices that value students' interests, cultures, differences, and families as assets that made students feel welcomed, safe, and nurtured in the classroom. Teachers planned questions and activities such as group exit tickets for student engagement in academic discourse and valued the empowerment of student voice. Teachers shared during the CPR meetings and CLE that they learned to talk less and ask more questions that stimulated student discourse. By the end of PAR Cycle Two, evidence showed that the teachers made student engagement in academic discourse a daily instructional routine.

I based the second finding, the importance of the administrator in the work of teachers on evidence, from field notes of CPR meetings and CLE field notes coupled with coaching conversation notes stating that the principal's role in coaching teachers with evidence-based conversations was critical to teachers shifting their practice. My role as principal was critical in directing teacher learning to include culturally responsive teaching. In addition to the recommendations in this chapter from the Grissom et al. (2021) study, the research results support a third recommendation: **"**to build a productive school climate [by using] practices that encourage a school environment marked by trust, efficacy, teamwork, engagement with data, organizational learning, and continuous improvement" **(**p. xiv).

I cultivated teacher change by supporting them to build a productive school climate as we engaged in teamwork, increased our use of data, focused on organizational learning, and sought continuous improvement over three cycles of inquiry (Yurkovsky et al., 2020). We expanded our learning to the full staff of the school through a community learning exchange. I facilitated productive collaboration in the CPR group as we formed a professional learning community and engaged in instructionally focused observations and conversations with teachers that were equity-based, data-driven, and culturally responsive.

Teacher change requires commitment, patience and flexibility as prior instructional practices are engrained in teachers' everyday routines (Cuban, 2012), and the grammar of schooling usually trumps change (Tyack & Cuban, 1995). As the school leader, I worked with teachers to interrupt old routines that did not equitably engage all students. Using observation tools, as principal, I captured and shared the data during coaching conversations with teachers in a supportive manner without judgment. We are cognizant of the changes teachers have made as

they intentionally engage all students and, in particular, enact more effective structures to engage African American students in math instruction.

CHAPTER 7: DISCUSSION AND IMPLICATIONS

A high quality education leads to a better quality of life, and learning mathematics is a key component for high quality learning. In fact, mathematics is a tool of liberation (Moses, 2001). As a school leader, I recognize that we give hope to the younger generation when we ensure our students have a solid mathematics foundation. Too often, teachers, students, and parents accept illiteracy in mathematics. Our school communities place importance on reading literacy but find mathematical illiteracy acceptable. As high-level mathematics is required for college or university entrance and most 21st century employment, students must acquire the necessary skills for succeeding in mathematics, starting with building a strong conceptual foundation in elementary school. In order for students to learn mathematics, teachers have to improve how they teach.

School leaders have to lead this change by placing equity and culturally responsiveness pedagogy at the center of student learning (Khalifa, 2018)—especially for African American students who, due to historically racist boundaries of access in our nation, are the lowest performing group in the country (Delpit, 2012). As an African American educator for 35 years and a school principal for 16 years, I embrace the charge of leading change in mathematics instruction at my school and in the education community. I have been disappointed to observe changes in mathematics standards, curriculum, and strategies in our district that did not benefit our students, and that led me to join the Project I^4 doctoral program. Through investigation of empirical research studies and literature, I have learned to support teachers as they shift their practice to using culturally responsive academic discourse to help students and families change their mindset to say, “I can do math.”

In this participatory action research (PAR) study, I examined how third through fifth grade teachers engaged African American students in academic discourse during conceptual mathematics instruction. The PAR study included three cycles of inquiry in which we had these recurring activities: co-practitioner researcher (CPR) group meetings, classroom observations followed by evidence-based coaching conversations, community learning exchanges (CLE), and reflections. As a result of the evidence in this study, teacher pedagogy shifted to include the implementation of improved questioning strategies and culturally responsive practices that elicited academic discourse as daily student engagement routines. I based the study on this theory of action: *If teachers effectively implement academic discourse routines in conceptual mathematics lessons, then teachers will equitably engage African American students.*

Teachers needed to develop culturally responsive practices in order to implement as these practices, which depended on having trusting relationships with students. When students experience trusting relationships with teachers, they can feel comfortable sharing their problem-solving strategies and taking risks with peers in the classroom. Teachers shifted their practices by developing questioning skills, learning the difference between closed and open-ended questions, asking probing questions, and becoming comfortable allowing for wait/think time as students responded. To implement these routines, the CPR group members reflected on their practices in CPR group meetings in which we learned about culturally responsive practices, as well as during coaching conversations in which we examined evidence about the types of questions teachers asked and how they called on students. As teachers shifted their practices, I shifted in my leadership style by coaching teachers with reflection questions during the PAR study.

The context of the PAR study was an urban Title One elementary school in Oakland, California, that serves a diverse student population. Forty-five percent of the students are African American, which is the majority of the school demographic. The vision of the school is to ensure academic and social success so every student can thrive. The school academic data revealed student progress in reading achievement. Mathematics data had revealed a decline after the implementation of the Common Core State Standards. As the testing requirements changed, teacher practices needed to change (Bambrick-Santoyo, 2018; Stein & Smith, 2018). Students were no longer using an algorithm to determine a correct answer. Instead, students were asked to show problem solving that required critical thinking skills and conceptual understanding of the mathematics grade level standards.

When teachers shared their personal journeys with mathematics, they revealed that their teaching style mirrored how they were taught. As students, they were taught to solve problems using algorithms and, as teachers, they were teaching students as they had been taught, a method that did not support conceptual understanding. Shifting teaching practices was necessary so that teachers would engage students in mathematics that developed their critical thinking and problem solving skills. According to the National Council of Teachers of Mathematics (2014), essential teaching practices that support student learning of mathematical concepts include facilitation of meaningful mathematical discourse using purposeful questioning. Therefore, the essential question for this study was: *How do third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction?*

In Chapter 1 of this study, the theory of action led me to identify the assets and challenges with mathematics instruction in micro, meso, and macro levels for the focus

of practice. Assets included a district wide adoption of a new mathematics curriculum that included more time for professional learning communities, new workbooks, additional manipulatives, and an opportunity for all grade levels to unite mathematical practices. The challenges included a fast pace with no time for re-engagement lessons towards mastery, lack of differentiated lessons, and lessons that covered the standards but did not allow for understanding of the mathematical concepts. The influence of the assets and challenges were considered during the study.

The PAR study, an 18-month action research project, consisted of three PAR cycles. In Table 14, I provide a summary of the activities that supported our efforts to equitably engage African American students in academic discourse during mathematics instruction. I consistently held monthly CPR group meetings and classroom observations followed by evidence-based coaching conversations. Following the CLE axioms, we held one CLE each PAR cycle and used protocols to engage in discussions and reflections. The evidence from the activities led to the findings that I connect to the extant literature in the discussion section. Then I connect the findings to the research questions and conclude with a frame for engaging African American students in academic discourse during mathematics instruction. Finally, I reflect on my leadership growth and development throughout the PAR project.

Discussion

In examining the PAR findings, I used sources from the original literature review and additional readings to discuss the emergent themes and the research questions. The findings are:

1. Teachers changed their academic discourse routines to foster equitable access.
2. Observations and post-observation conversations facilitated by the school leader supported teachers to shift to culturally responsive practices.

Table 14

Key Activities: Three PAR Cycles of Inquiry

Activities	PAR Pre-Cycle Spring 2022 Jan - May, 2022)	PAR Cycle One Fall 2022 August-Nov, 2022	PAR Cycle Two Spring 2023 Jan-May, 2023
Meeting with CPR members (n=14)	*****	****	*****
Community Learning Exchange (n=3)	*	*	*
Classroom Observations Formal (n=15)		*****	**********
Coaching Conversations with CPR members (n=12)		****	********
Conversations with ECU Professors (n=13)	****	****	*****

After I connect the findings to the literature, I propose a framework for changes in teacher and leadership practice that consists of key components to change mathematical teaching practices of questioning students and engaging students in equitable culturally responsive academic discourse.

Teachers' Pedagogical Shifts: Equitable Access

During the course of this PAR study, teachers shifted their pedagogy to include routines for equitably engaging African American students in academic discourse during mathematics instruction. All of the group members shared descriptive accounts of their elementary, secondary, and college learning experiences. Teacher personal interactions with mathematics were important to recall and examine as an inquiry into their teaching pedagogy with mathematics content, learned patterns, and pedagogy exposure. Teachers' lived experience comprises their knowledge and skill (Moll et al., 1992) and contributed to the pedagogical choices they were using. The grammar of schooling that they experienced as K-12 learners influenced the instructional choices they made (Tyack & Cuban, 1995), and changing those practices is complex; as Cuban (2023) states, teachers teach the ways they were taught. Thus, teachers had to examine their math journeys and adjust their thinking, decide on new routines, and shift their pedagogy.

Teacher Math Journeys: They Teach Like They Were Taught

As teachers reflected on their mathematical journeys, they highlighted evidence showing that their experiences shaped their teaching practices. The National Council of Teaching Mathematics (2014) agrees that teachers' perceptions about mathematics from their experiences influence their teaching. The five CPR group members had positive early educational experiences with mathematics, but they recalled that before third grade, mathematics learning

included engagement in free play activities such as using blocks as manipulatives, playing store, and other play-based learning activities.

As these teachers moved to upper elementary grades, however, four of the five CPR members expressed that their relationship with mathematics became challenging, as early as third grade. According to their recollections, worksheets replaced manipulatives, and their teachers typically directed them to work silently and individually to solve problems, contrary to what Allen and Boykin (1992) and Hammond (2015) urge for communal learning as one attribute of culturally responsive pedagogy. They did not recall intervention or support with learning mathematics concepts or with challenging problem solving. I examined evidence from the observations, CPR meetings, and reflections to conclude that most teachers taught mathematics with a similar style gained from their experiences as mathematics students. For example, I observed teachers giving instructions with steps to solve problems as a basic algorithm; at the start of the project and study, they called solely on raised hands of one or two students to check for understanding, and they assigned students 10-25 mathematics problems to solve independently. At the end of the lesson, the teachers collected the student work, corrected it later in the day, and returned it to the students before the teacher moved on to the next lesson. These practices contradict what we know about effective learning, including the need for information processing that incorporates what we know about the brain and learning (Hammond, 2015), inter-subjectivity to support students stretching into their zone of proximal development (Vygotsky, 1978), and culturally responsive and equitable access and cognitive rigor (Boykin & Noguera, 2011).

During the community learning exchange (CLE), the CPR group and other school community members had the opportunity to share ideas (Guajardo et al., 2016) about how they

were taught and how they should teach now. Teachers affirmed that they were taught using the banking style of education (Freire, 2007) in which teachers deposit information and hope students will recall and apply. They shared feelings of inadequacy in learning mathematics which progressed to low achievement as they attempted higher mathematical classes in preparation for college entrance. Teachers described their relationship with mathematics as one of fear and defeat. Teacher D used the term "math wounded" as he recalled his study of higher level mathematics. The CPR group is racially mixed with three African American men and two White women. Their experiences in learning mathematics were similar for four of the five teachers from both racial groups. The outlier was the youngest member of the group, an African American male. He shared that project based learning experiences served as the method for most of his mathematical learning experiences and recalls learning the concepts well enough to also learn computation quickly. Because learning happens by doing (DuFour, 2016), students need to effectively engage in collaborative learning experiences for effective learning. DuFour (2005), who popularized the use of professional learning communities, said, "Those who have a genuine interest in leading school improvement initiatives must recognize that schools will not produce students as continuous learners and effective collaborators without teachers who have these same characteristics" (p. 81). Because the brain is a social organ (Hammond, 2015), students and adults learn from on-going dialogue—social learning (Resnick, 1991).

As we advanced through the PAR Pre-Cycle and PAR Cycles One and Two, the CPR group members recognized that their pedagogical methods were similar to how they learned mathematics, methods that resulted in a lack of engagement and lack of confidence. With that realization, teachers recognized how changing student outcomes required pedagogical changes. The teachers valued the need for engaging students in equitable academic discourse as a means

for learning mathematical concepts and began shifting their practice to include more engagement. However, these shifts did not happen immediately. The process for change began with incremental steps such as rearranging the classroom furniture for cooperative group learning, developing questioning strategies with appropriate wait time for student responses, and using equitable academic discourse protocols to meet the diverse needs of all students (Lyman et al., 2023).

Shifts in Academic Discourse

Teachers actively engaged and supported African American students during mathematics instruction with academic discourse (Delpit, 2012; Ladson-Billings, 2009). Students learn most when collaborating with others through discourse, and students need to engage in academic discourse to learn (Hammond, 2015; Vygotsky, 1978). The results observed when teachers applied equitable engagement practices for academic discourse during mathematics instruction supported this belief that teachers wanted to transfer to practice.

However, as African American students participate in classroom instruction, teachers must consider a host of issues, including the systemic issues of racism. Societal racism has resulted in African American people thinking of themselves as inferior, and they are therefore less likely to engage in learning (Kendi, 2019; Khalifa, 2018). Further, African American students may be reluctant to share ideas. By elementary school, African American students have been subjected to the stereotype threat of being less capable, and the anxiety that this threat creates in the brain's amygdala is well-documented (Steele, 2010). Teachers are central to eradicating the myth that poor children and children of color are incapable of learning at advanced levels; therefore, they need to build instructional practices that encourage and support all children in learning (Muhammad, 2020). For example, using equity sticks to call on a few

students to speak was a common teaching practice at our school. Using proactive strategies that engaged all students in academic discourse such as the effective use of think-pair-share (Lyman, 1989; Lyman et al., 2023) and purposely calling on African American students using sentence starters and probing questions with adequate wait time, allotted more opportunity to ensure that all students participated.

During the PAR study, teachers' pedagogy shifted to include academic discourse as a daily routine. The teachers re-organized their classrooms to ensure that students could pair or work in small groups to provide a variety of student groupings throughout the mathematics lessons. As students engaged in academic discourse, the metacognitive process of formulation of words and expressions became an important part of their learning (Zwiers & Crawford, 2011).

Teachers planned questions that allowed students to explore a myriad of problem solving strategies. Students used protocols to give each group member the opportunity to speak and share their critical thinking skills. Through the academic discourse during mathematics instruction, students clarified their understanding of concepts, made arguments, and learned from peers. Engagement in academic discourse provided opportunities for students, especially African American students, to develop academic vernacular as they used mathematics vocabulary. Engaging students in academic discourse as a daily routine required the teachers to plan ahead to develop questions that would generate problem solving and critical thinking skills discussions. Questioning became an integral part of engaging students in academic discourse as a daily routine during mathematics instruction. The importance of including all students in academic discourse as a daily routine required teachers to implement culturally responsive practices.

In sum, teachers changed their academic discourse routines to foster equitable access. As teachers reflected on their personal journeys with mathematics, they recognized that the banking

style of teaching they received as students did not promote academic achievement or a positive relationship with mathematics. The teachers shifted their teaching practices and reorganized their classrooms to promote cooperative learning, planned questions, employed sentence frames, and used discussion protocols as they engaged students in academic discourse as a culturally responsive practice for teaching mathematics.

Culturally Responsive Practices: A Result of Observations and Conversations

As the school leader, I facilitated observations and post-observation coaching conversations to support teachers to shift to using culturally responsive practices. As indicated in the first finding, teachers traditionally teach the way in they were taught. The habits and practices are often deeply rooted as routines (Cuban, 2013; Tyack & Cuban, 1995) which did not include culturally responsive teaching practices. Culturally responsive teaching practices should include classroom environments in which students feel safe and supported as they take academic risks when learning (Hollie, 2018). The teachers used norms and practices to establish safe spaces for student learning and gained knowledge about the family, culture, assets, and growth areas for each student (Hammond, 2015). In my observations of the CPR group members, I looked for culturally responsive teaching practices in which the teacher acknowledged students' interests, culture, and strengths.

The Meaning of Cultural Responsiveness

Gloria Ladson-Billings (2009) defines culturally responsive teaching as a pedagogy that empowers students intellectually, socially, emotionally, and politically by using cultural and historical references to convey knowledge, to impart skills, and to change attitudes. As one of the pioneers in this field, Ladson-Billings emphasized the importance of the connection between the teachers and their students. Culturally responsive is the teacher practice of recognizing and using

the unique strengths of students. Geneva Gay (2000), another leader in this field of study, defines culturally responsive pedagogy as the use of cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them.

Based on these definitions, the CPR group learned the importance of building trusting relationships with students and their families. We learned about the assets, talents, and interests of the students as we planned lessons, activities, and selected literature. As I engaged my teachers in learning about culturally responsive practices throughout the PAR cycles, we studied the neuroscience work of Zaretta Hammond (2015) and the importance of creating emotionally safe classrooms that empowered students to engage in academic discourse as a daily routine and cultivate the genius of each student (Muhammad, 2020). We learned that the brain is a social organ and that it uses students' culture to process data and information. Therefore, as culturally responsive educators we must validate and affirm students' interests, talents, skills, and overall culture by being intentional and purposeful in the lessons we plan for our students (Hollie, 2018).

Engaging students in academic discourse during mathematics instruction was a culturally responsive practice. Academic discourse provides students the opportunity to collaborate, engage in movement activities, and use discussion protocols relevant to the students' interests, assets, and overall culture. Culturally responsiveness acknowledges students' current situations to engage them, with the intention of helping them acquire more knowledge through academic discussions. To support culturally responsive practices, I conducted observations and had conversations that supported each teacher in ways that mirrored the ways I hoped teachers would support students.

Observations and Post Observation Conversations

I observed classrooms by taking selective verbatim notes, and I based the post-observation coaching conversations on evidence (Acheson & Gall, 1997; Tredway et al., 2019). I used the questioning tool and the calling-on tool to collect data (https://education.ecu.edu/projecti4/resources/). I tallied the types of questions that teachers asked and which students they called on. I tallied how they used think time, and when they used scaffolding or probing questions with individual students.

During the post observation coaching conversations, I reported the data from the observation tools. Through the use of these effective observation tools, teachers received specific and usable data to reflect on their classroom practices. Some teachers were surprised about the number of times they called on hands or how often they responded to the student who blurted out. As they reviewed their data, they were empowered as co-practitioner researchers to take an active role leading toward continuous improvement in their practices (Yurkovsky et al., 2020). I did not tell them what to do. Instead, I guided them to decide what changes they should make for the betterment of their students. As the teachers continuously improved their practice, their pedagogical methods began to shift to align with culturally responsive practices.

In this PAR study, I focused on systemic use of data through observations and post observation evidence-based coaching conversations (Huff et al., 2018). I collected data and collaborated with teachers about the evidence, leading teachers to see the changes they needed to make in their practice. As we set goals during the collaborative conversations, the teachers planned lessons with higher-level cognitive questions. For example, teachers were initially quick to call on students who they knew had the correct answers or who could effectively solve the mathematics practices. Reflection on the inequity inherent in this common practice caused

teachers to shift and value calling on students who needed support with productive struggle, probing questions, and wait time. Using culturally responsive teaching practices, the teacher would refer to the interests of the students to encourage them. When a student who struggled with mathematics facts reluctantly participated in problem solving, the teacher used the student's admiration of NBA basketball star Stephen Curry of the Golden State Warriors to frame a culturally responsive reply. The teacher reminded the student that the NBA player once struggled to make three point shots, but with practice, Curry began to excel at making three point shots because he kept trying and was focused. This culturally responsive exchange allowed the student to relate to the potential progress with practice and focus. As I reviewed the evidence of this classroom observation with the teachers, they reflected on the relationships they built with students and began to shift their practices.

Observation with data and the application of common tools, including the Calling On Tool (see Appendix E) and the Questioning Tool (see Appendices F and G) were critical to helping improve conditions for learning. The common tools for observation and evidence-based professional coaching conversations (Ahn et al., 2021; Wong et al., 2021) supported the shift in pedagogical practice. Because a common tool offers a chance for social and material learning, the tools acted as mediators of learning and supported a group of teachers. As I used the tools across individual observations in classrooms, teachers made connections among them in CPR meetings and shared ideas about how to change their practices, supporting the importance of collecting data to make decisions about professional learning for teachers based on data in classrooms (Grissom et al., 2021).

The use of consistent observations followed by evidence-based coaching conversations supported our iterative small cycles of inquiry with pragmatic data (Cobb et al., 2011). Teachers

could observe their improvements in their practice through the course of the PAR cycles and make institutionalized change based on the evidence-based coaching conversations.

Framework for Change

As a result of this study, I developed a framework for supporting teachers to implement equitable and culturally responsive academic discourse for engaging African American students: *Supporting Change in Teacher Practice: Promoting Equitable and Culturally Responsive Academic Discourse* (see Figure 24). Critical to the framework is that the school leader, as an equity leader, must take critical action steps to support teachers. We engaged in focused learning as a CPR group to improve equitable conditions for all students during mathematics instruction. As an equity leader, I engaged teachers in Plan, Do, Study, Act (PDSA) cycles of inquiry with evidence-based coaching, a method of improvement science (Bryk et at., 2015), as we studied the data from the classroom observations. As the collaborative team focused on assets and supported each other, teachers developed trust in each other, the leader, and the process. The understanding of non-punitive judgements during the observations and coaching conversations led to shared experiences and our ability to use evidence iteratively to diagnose and design (Spillane et al., 2012; Spillane, 2013). The processes were iterative and collaborative.

During all PAR cycles, we cultivated relational trust, chose observation tools collaboratively, used evidence-based coaching conversations to reflect and set goals, and agreed upon professional development based on data from our classrooms. Incrementally, teachers shifted their practices to include student engagement in academic discourse as a daily routine during mathematics instruction. The framework aligns with the recommendations of the Grissom et al. (2021) meta study of effective instructional leadership in which the school leader is pivotal in setting up the necessary conditions and structures for shifts in teacher practices. I have shared

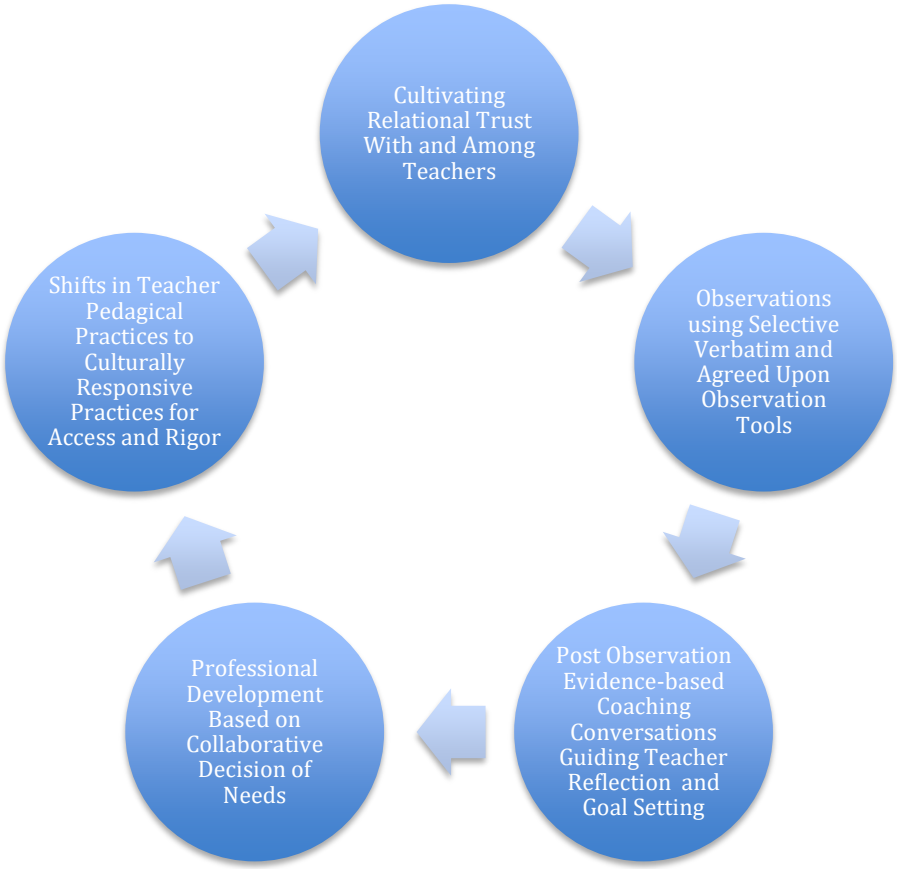


Figure 24. Framework for changing teacher practice to promote equitable and culturally responsive academic discourse.

points in the recommendations in Chapter 6 to support the findings, and the full set of recommendations are:

- Building a productive school climate.

  Adopt practices that encourage a school environment marked by trust, efficacy, teamwork, engagement with data, organizational learning, and continuous improvement.
- Engaging in instructionally focused interactions with teachers. Enlist forms of engagement with teachers that center on instructional practice, such as teacher evaluation, instructional coaching, and the establishment of a data-driven, school-wide instructional program to facilitate such interactions.
- Facilitating productive collaboration and professional learning communities. Focus on strategies that promote teachers working together authentically with systems of support to improve their practice and enhance student learning. (p. xiv, emphasis in original text).

In the PAR, we collaboratively decided to learn more about culturally responsive teaching practices. Through a book study, we understood that the brain is a social organ and that students learn best when collaborating with others through discourse (Hammond, 2015). That realization was a catalyst for the shifts in teacher practice as we began to fully understand the cornerstone practices of the Ready for Rigor Framework and culturally responsive practices for African American learners. Thus, we emphasized collaborating as teachers to promote collaborating in the classroom, understanding the brain as a source of cognition and potential learning anxiety, engaging in learning partnerships as adults and students, emphasizing sufficient time and

attention to the tenets of information processing, and making space for student voice and agency through classroom academic discourse routines.

Review of Research Questions

The overarching research question guiding the PAR study was: *How do third through fifth grade teachers implement equitable and culturally responsive academic discourse to support African American students during mathematics instruction?* The four sub questions were:

1. To what extent do teachers effectively plan to use culturally responsive academic discourse routines during mathematics instruction?
2. To what extent do teachers effectively implement culturally responsive academic discourse routines during mathematics instruction?
3. To what extent did observations and post-observation conversations support teachers to shift their practices to be equitable and culturally responsive?
4. How does the process of engaging African American students in equitable and culturally responsive academic discourse during mathematics instruction support my growth and development as an instructional leader?

The theory of action for this study was: *If teachers effectively implement academic discourse routines in conceptual mathematics lessons, then teachers will equitably engage African American students.*

Over eighteen months, the co-practitioner researchers and I met regularly as a collaborative team to engage in professional learning. The teachers in this study supported each other by sharing ideas, resources, and planned questions for equitable engagement of students. I provided professional development to expand the understanding for the need for equitable

student engagement in academic discourse (Zwiers & Crawford, 2011). We examined the importance of the types of questions and the importance of how and when teachers called on students (Stein & Smith, 2018) in addition to allowing adequate wait time for students. Our collaborative professional learning included readings on anti-racist practices (Kendi, 2019) and cultivating the genius in all students (Muhammad, 2020) with a growth mindset and belief that all children are capable of learning. As a result, we improved practices by implementing equitable academic discourse during mathematics instruction. Classroom observations, evidence-based coaching conversations, and reflection led to teacher pedagogical shifts to include questioning strategies that equitably engaged students in discourse as a daily instructional routine.

Secondly, teachers included academic discourse routines as daily instructional practices, which supports Cuban's (2021; 2013) work citing the need for school reform. In his study, he observes that changes are made in schools without first understanding the context of how teachers are implementing curriculum. We found that the structure of the habitual daily routines needed to be adjusted to include student engagement in academic discourse. The intentionality of planning questions, selecting discussion protocols, and monitoring student voice were vehicles that led to shifts in teacher practice. During our CPR meetings and CLE, the teachers publicly shared their reflections within the collaborative CPR group and contributed suggestions on questioning strategies and engaging students in academic discourse. Teachers shared a common delight in seeing students fully engaging in academic discourse and remaining focused on the topic. The teachers shifted their practice to create conditions that promoted student engagement in academic discourse by planning and implementing questions that engaged all students. In this

study, the CPR members were active participants in leading change, resulting in equitable results for students.

Finally, by fully investigating precisely what is meant by culturally responsive pedagogy (CRP), the teachers, who were committed to improving the learning outcomes of African American students, saw the benefits of Hammond's rigor framework as they re-designed their classrooms to promote a community of learners. They experienced being in a community of learners as teachers in the CPR group and, as student participation shifted and more students responded to their shifts in pedagogy, the teachers began to view CRP as meaningful and possible. While the study has officially concluded, the teachers and I are committed to what we learned; discussing CRP helped them understand what it meant and how they could specifically enact CRP in their classrooms; observations with data help teachers make instructional decisions, and regular professional learning as an internal school responsibility helped to foster the practices they believed would support students (Grubb & Tredway, 2010), giving credence to the CLE axiom: "The people closest to the issues are best situated to discover answers to local concerns" (Guajardo et al., 2016, p. 25).

Implications

The framework developed in this PAR study offers a guide for other schools, school districts, educators, and educational policy makers who need to make shifts in teacher pedagogy. At the micro, meso, and macro levels of educational organizations, we observe non-effective teaching practices that become habits. By building trusting relationships with teachers, coupled with observations and evidence-based coaching conversations, leaders can support teachers to make shifts in their practices.

The observation tools offer a consistent process for the leader or teacher leaders or peer observers to use data to inform classroom practices. The importance of who is talking in classrooms should be a prime consideration as all students need high levels of engagement in academic discourse to effectively learn mathematical concepts. Although the study centered on mathematics instruction, academic discourse in other subjects would benefit from the framework. The importance of guiding teachers to reflect on their practices to implement change, as opposed to directly telling teachers what they must do, supports what we know about adult learning and teachers' need for agency in classroom decisions (Drago-Severson, 2012). The process of effective teacher change takes time but the results make the invested time worth the process. The study has implications for practice, policy, and further research.

Practice

The PAR findings promote promising practices for teachers and school leaders. As a result of participation in this PAR, the CPR members shifted their practices and developed effective strategies for equitable student engagement in academic discourse. As teachers recognized the importance of equitable engagement for all students, they began to rearrange their classrooms, plan questioning strategies, and use protocols to ensure participation during mathematics lessons.

The effectiveness of the shift in teacher pedagogy is relevant to their overall development as teachers in all subjects. As teachers engaged students in academic discourse about mathematics, they began to use the same practices during reading, social studies, and science lessons. Teachers learned to ask open-ended questions across all genres of the curriculum. The findings demonstrate that if teachers plan questions for any subject area and use protocols for equity of voice, students will engage in academic discourse. As the school leader, I could

observe teachers using selective verbatim, collect data on their questioning and calling on strategies for any subject area, and engage in evidence-based coaching conversations. Therefore, the framework provides a sequence of events for an instructional process that promotes equity. The PAR process could be useful for any subject area or school context to promote equity and continuous improvement by the persons closest to the issues who are best situated to address local concerns (Guajardo et al., 2016). Thus, while the exact study is not replicable, the processes and frameworks are usable for schools and districts.

Policy

The PAR was designed to address the need for equitable participation by African American students in academic discourse during mathematics instruction. At the local, state, and national level, African Americans have been underserved in making significant growth in learning, and they are not adequately encouraged to enroll in higher level mathematics classes in high school that lead to higher education (Moses, 2001). Quality education is a critical civil right because education opens the doors of opportunity for employment and careers, a fact that is especially relevant in a world currently driven by technology. Although our district has adopted new mathematics curriculum, school leaders need to ensure teachers are using it effectively by regularly observing teachers with walkthrough observations and scheduled observations that give feedback via coaching.

Districts should value the evidence-based coaching model that uses tools that target effective teaching practices, such as effective questioning and student engagement in discourse via small groups or partners. These recommendations support change at the meso level and can support teacher observations as a learning experience with involvement from the site leader that encourages teacher reflection.

Secondly, I suggest that school districts provide the necessary time for teachers to collaborate and reflect on their practice. The study findings indicate that if teachers effectively engage in cycles of inquiry such as the PDSA process used in this study, they can use pragmatic school data to make changes. When school districts support teacher collaboration and planning time, they support the process of continuous improvement. Sustainable structures such as weekly professional learning communities support teachers' need to engage in discourse about teaching and learning which can lead to improved practices.

Lastly, I would encourage state officials to fund teachers to return to school two weeks before the return of the students. In California, public school teachers are given three days to set up physical classrooms, learn new curriculum, organize supplies, count textbooks, plan school culture, and academic lessons for the first six weeks with grade level colleagues. Policy should reflect that teachers require two weeks to plan a successful beginning of the school. In the current structure, teachers are not compensated for the time they require to adequately prepare their classrooms and develop lesson plans for new curricula. A change in policy could provide teachers with the time they need to set up for a successful school year.

Research

During this PAR study, I used community learning exchange axioms (Guajardo et al., 2016) and activist research, using improvement science principles to implement a qualitative study that used the following principles: make the project problem-specific and user-centered; accelerate improvement through communities of practice (CoP); develop an iterative improvement process and respond to teacher understandings; and believe in the power of conversation and honor local wisdom. Using these research methods, we anchored our PAR

study in improvement practices. We read relevant literature that contributed to our understanding of this PAR study with evidence-based studies that guided us as we gathered and analyzed data.

As I used a participatory action research approach in this study, I gathered and analyzed the evidence to share with the CPR team so that we could collaboratively make decisions and improve practice. Using observation data of selected verbatim, the questioning tool, and/or the calling on tool, we gathered authentic evidence to have meaningful coaching conversations that were a reflective process for teachers and the school leader. Our reflections informed the next steps at the school level for engaging African American students in academic discourse to learn mathematical concepts. Research of this type—uncovering the details of how teachers change practices—is needed to inform school communities and change teacher practice. The research informs what happens in the "black box" of teaching and learning (Cuban, 2013), and action research at the local school level can replicate our processes and make local decisions about change efforts for their professional learning requirements.

A second research recommendation is to examine more closely how evidence-based coaching conversations support teacher change in practice, both in supervision and evaluation practices. Based on school district guidelines, school leaders give feedback to teachers based on a checklist of items such as posting the learning objective, use of curriculum, word walls, use of equity tools, and other classroom management strategies. In addition, school leaders give teachers feedback based on student performance. However, the research of this study supports the idea that classroom observations using evidence-based data collection tools about questioning and calling on students, coupled with post observation evidence-based coaching conversations, led to teacher choices and change in their practice. The evidence collected in this

PAR study resulted in proving the methodology of improvement science as a useful process for shifting teacher practice.

Limitations

Several limitations had an impact on the PAR study. First, my position as the principal and instructional leader as well as the lead researcher gave me an insider view of the research, which was a strength and a limitation. As I was the co-practitioners' supervisor at the school where this study was conducted, I was working in collaboration with other insiders (Herr & Anderson, 2014). The COVID pandemic created unprecedented challenges for this research as we began this study with virtual learning. When we returned to the classroom after a year with synchronous and asynchronous learning, we continued to face restrictions on in-person gatherings resulting in online CPR and CLE meetings during the PAR Pre-Cycle.

Another limitation was the size of the study. We collected rich data with five members in the CPR group. However, to impact larger groups of teachers, we would need to magnify the findings. The data we collected was helpful to the participants in our school; similar small projects and studies in other schools could support additional evidence that using key processes can effect school change.

Leadership Development

As I reflect on my leadership growth from this PAR study, I examine my journey as a school leader. In my experience as a school leader for fifteen years, I realize that my district trained me to focus on students' performance data, hold data conferences with teachers after each student assessment cycle, and ask the teachers to set goals for improving student data. The information that I gathered from this study sharpened my knowledge about the importance of observing and collecting data about teacher practice and not solely concentrating on student

performance data. By reading research articles and books and joining in conversations with other school leaders and university professors about the research, I increased my knowledge and awareness about equity, evidence based conversations, academic discourse, brain function, and culturally responsive pedagogy. As I observed the importance of shifting teacher practice, I became aware of the importance of shifting my own practice. Through the community learning exchange, I learned to value giving teachers time to reflect and grow organically from the exchange of ideas.

In the summer of 2019, I joined the Project I^4 Cohort and learned about creating gracious space, using dynamic mindfulness practices, and implementing the CLE axioms. As I returned to my school to begin this PAR study, I engaged my team in these practices. As we formed our CPR group, I supported teachers to speak without fear of judgment as we discussed difficult topics such as racial equity, social justice, and developing a growth mindset. Inviting all staff to share their personal narratives created an atmosphere of inclusion and relational trust. Beginning each collaborative session with dynamic mindfulness breathing and stretching exercises grounded us with presence and physical awareness as we learned to release early events of the day and focus on the tasks of participatory research.

Learning about the CLE axioms was critical to my leadership growth. I valued the new learning and incorporated the axioms throughout the PAR. Teachers are closest to impacting student learning and are best situated to discover what supports are needed for improvement (Guajardo et al., 2016). Keeping this fact in mind, I learned to create opportunities to listen and learn from teacher experiences during the CLE. As we discussed Muhammed's (2018) framing of students as geniuses that need to be cultivated, I learned to value teachers as geniuses that needed opportunities to share and reflect. In preparation for the CLE, I learned to plan questions

that supported sharing of personal narratives, self-reflection, identification of assets and growth areas. After each CLE, I felt I had received golden nuggets of perspectives that were valuable to me as the school leader. I was thankful for the learning I received from participation and reflections of the CLE and vow to continue to build in time for reflection for teachers and my school community.

In addition to learning to become a leader who values reflection, I learned the importance of holding coaching conversations with teachers in post-observations as opposed to giving them direct feedback. Collecting data during the observations with tools that our CPR group agreed to use and asking teachers questions that promoted self-reflection about the data led to teachers naming their own areas for change. This style of observation and coaching proved to be a valuable leadership move that supported teacher change in practice.

As I reflect on my participation in this study, I am grateful for the exposure to excellent assigned readings. As an African American female equity leader in education, I strengthened my arsenal of facts and theory from the course readings and research examinations. Learning about the Algebra Project from Bob Moses (2001) supported my belief that it is a civil right for African American students to learn mathematics, a right that more people should be defending. From Ibrahim X Kendi (2020), I learned that all people have racist beliefs that we need to acknowledge and address. Learning about pedagogy and the relationship between student and teacher with the need to move away from the bank style of education (Freire, 1974) was critical to my leadership development. Wilkerson (2020) taught me that the foundation of this nation is like a house built on unstable bricks with bad plumbing in need of grave repair. Reading about Plenty Coups (Lear, 2006) taught me that even in the face of despair, we need to believe that we can keep going forward and adjust as necessary for survival. Of all the readings, I questioned the

actions of Plenty Coups, the last great Chief of the Crow Nation, as he ceased to fight, but learned that survival, as opposed to extinction, gives hope that we can move forward even when vulnerable to historic forces.

Lastly, I am most grateful for all of the professors and cohort members that supported this PAR study. As equity warriors leading necessary change in schools across our nation, there is hope that our nation, and communities, one school at a time, will improve teacher practice and learning conditions for students.

Conclusion

As an instructional leader, even after many years in this work, I have learned the importance of reflection through involvement in this study. Self-reflection and giving others involved in the study time to reflect was a key component of learning in every area. Internal reflection allowed me time to step back and think, review, and consider others before making plans.

I learned that the brain is a social organ that learns best in collaboration with others (Hammond, 2015), a fact that summed up the need for this PAR and its focus on creating equitable conditions for students to engage in culturally responsive academic discourse. I can imagine classrooms across our nation where students are no longer told to work independently and quietly but are encouraged to engage in academic discourse that allows them to develop critical thinking and problem solving skills. This study gave students in one urban school in Oakland, California, the opportunity to lift their voices and learn as they engaged in discourse. This PAR study was small but powerful as teachers shifted their pedagogy and the school leader shifted leadership practices.

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APPENDIX A: INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board
4N-64 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** ·
rede.ecu.edu/umcirb/

Notification of Exempt Certification

From: Social/Behavioral IRB
To: Zarina Ahmad
CC: Matthew Militello
Date: 12/7/2021
Re: UMCIRB 21-001674
Black Lives Matters: Engaging African American Students in Conceptual Mathematics

I am pleased to inform you that your research submission has been certified as exempt on 12/7/2021. This study is eligible for Exempt Certification under category # 1 & 2ab.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

Document	Description
Adult Consent Forms(0.01)	Consent Forms
Ahmad Dissertation Proposal(0.01)	Study Protocol or Grant Application
CALL Survey(0.01)	Surveys and Questionnaires
CLE Agenda(0.01)	Additional Items
CLE and Group Interview Questions(0.01)	Interview/Focus Group Scripts/Questions
Data Collection Instrument - Community Learning Exchange Protocol(0.01)	Interview/Focus Group Scripts/Questions
Data Collection Instrument - Reflective Memos(0.01)	Additional Items
Data Collection Instrument : Coaching Conversation Protocol Protocol Post-Observation Conversations(0.01)	Additional Items
Data Collection Instrument Question Form Protocol-Observation Tool- Calling On Tool(0.01)	Additional Items
Data Collection Instrument-Classroom Observation Form(0.01)	Additional Items
Data Collection Instrument-Question Form Protocol(0.01)	Additional Items

APPENDIX B: CITI TRAINING CERTIFICATE

CITI PROGRAM

Completion Date 06-Jan-2021
Expiration Date 06-Jan-2024
Record ID 40230781

This is to certify that:

Zarina Ahmad

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Human Research
(Curriculum Group)
Group 2.Social / Behavioral Research Investigators and Key Personnel
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

East Carolina University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w734d37ca-1ec6-45bc-92e6-37973ae4edd6-40230781

APPENDIX C: SCHOOL DISTRICT PERMISSION

OAKLAND UNIFIED SCHOOL DISTRICT
Community Schools, Thriving Students

Statement of Research Approval

Title of Research Project	Conceptual Mathematics and Black Lives Matter: How teachers equitably engage African American students in understanding conceptual mathematics through academic discourse
Researcher	Zarina Ahmad
Institution/Organization	East Carolina University
Date	September 19, 2021
Research ID	210910

To OUSD Principals and Leaders,

The proposed research has been approved by the OUSD Research Review Committee. The proposed research has been determined to be in compliance with existing legal and ethical research guidelines. The researcher has agreed that the study will not differ significantly from the activities described within the proposal that was submitted to the Research Review Committee. The researcher has stipulated that all participation will be voluntary, and it is understood that **approval of the proposal will not obligate any person, school, or department in OUSD to participate**. The researcher ensures that all student or staff data provided by the district will not be shared with other researchers or organizations. The researcher is obligated to submit any amendments to the original proposal to the Research Review Committee for approval before further research is permitted. The researcher agreed to provide the Office of Research & Assessment and each participating school with a copy of the research findings.

I am available to assist you with any questions regarding the research after you have discussed it with the researcher. Please call/email me if you have any questions about the research before or after it has been conducted.

Sincerely,

Kaia Vilberg
Statistician
Research, Assessment & Data
Kaia.Vilberg@ousd.org

APPENDIX D: CONSENT FORM: ADULT

Informed Consent to Participate in Research

Information to consider before taking part in research that has no more than minimal risk.

Title of Research Study: Conceptual Mathematics and Black Lives Matter: How Teachers Equitably Engage African American students in Understanding Conceptual Mathematics

Principal Investigator: Zarina Ahmad
Institution, Department or Division: East Carolina University, Department of Educational Leadership
Address: 3273 Blandon Road, Oakland, CA 94605
Telephone #: 510-798-5056
Study Coordinator: Dr. Matthew Militello
Telephone #:252-328-6131

Researchers at East Carolina University (ECU) study issues related to society, health problems, environmental problems, behavior problems and the human condition. To do this, we need the help of volunteers who are willing to take part in research.

Why am I being invited to take part in this research?

The purpose of this participatory action research (PAR) is to examine to what extent teachers can co-design and implement conceptual mathematics lessons that will equitably engage African American students. You are being invited to take part in this research because of the role you have within the school setting and would make a great volunteer. The decision to take part in this research is yours to make. By doing this research, we hope to learn together as a team of co-practitioners how to better engage our African American students in learning mathematical concepts.

If you volunteer to take part in this research, you will be one of about fifty people to do so.

Are there reasons I should not take part in this research?

There are no known reasons for why you should not participate in the research study.

What other choices do I have if I do not take part in this research?

You can choose not to participate.

Where is the research going to take place and how long will it last?

The research will be conducted at Piedmont Avenue Elementary School in the Oakland Unified School District. You will need to come *to the multi-purpose room approximately fifteen times* during the study. The total amount of time you will be asked to volunteer for this study is fifteen hours over the next fourteen months.

What will I be asked to do?

You will be asked to do the following: you may be asked to participate in co-practitioner research design and planning meetings, classroom observations, coaching conversations, an anonymous survey, and attend community learning exchanges during the study. The co-practitioner research design and planning

meetings, classroom observations, coaching conversations and community learning exchange may be recorded in addition to handwritten notes by the research team members. All of the meetings will focus on your experience with co-designing and implementing conceptual mathematics lessons that engage African American students at Piedmont Avenue Elementary School.

What might I experience if I take part in the research?
We don't know of any risks (the chance of harm) associated with this research. Any risks that may occur with this research are no more than what you would experience in everyday life. We don't know if you will benefit from taking part in this study. There may not be any personal benefit to you, but the information gained by doing this research may help others in the future.

Will I be paid for taking part in this research?
We will not be able to pay you for the time you volunteer while being in this study.

Will it cost me to take part in this research?
It will not cost you any money to be part of the research.

Who will know that I took part in this research and learn personal information about me?
Only the lead researcher will know that you are part of this research and unique identifiers will be used so that names are not associated with the research participant and data.

How will you keep the information you collect about me secure? How long will you keep it?
The information in the study will be kept confidential to the full extent allowed by law. Confidentiality will be maintained through the data collection and data analysis process. Consent forms and data from surveys, interviews, and focus groups will be maintained in a secure, locked location and will be stored for a minimum of three years after completion of the study. No reference will be made in oral or written reports that could link you to the study.

What if I decide I don't want to continue in this research?
You can stop at any time after it has already started. There will be no consequences if you stop and you will not be criticized. You will not lose any benefits that you normally receive.

Who should I contact if I have questions?
The people conducting this study will be able to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator at 510-798-5056 (days, between 8:00 am and 4:00 pm or email ahmadz19@students.ecu.edu.

If you have questions about your rights as someone taking part in research, you may call the University & Medical Center Institutional Review Board (UMCIRB) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director for Human Research Protections, at 252-744-2914.

I have decided I want to take part in this research. What should I do now?
The person obtaining informed consent will ask you to read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answer.

- I know that I can stop taking part in this study at any time.
- By signing this informed consent form, I am not giving up any of my rights.
- I have been given a copy of this consent document, and it is mine to keep.

Participant's Name (PRINT)	**Signature**	**Date**

Person Obtaining Informed Consent: I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above and answered all of the person's questions about the research.

Person Obtaining Consent (PRINT)	**Signature**	**Date**

Zarina Ahmad	**Signature**	**Date**

APPENDIX E: OBSERVATION TOOL: CALLING ON

Type One of Calling On: Make a seating chart.
Using a seating chart to determine equitable calling on is critical. Too often, some students are totally overlooked – they may not raise their hands, or, if they do, teachers ignore them. If possible, write student names if you know them. Identity (F/M or race/ethnicity): AA= African American; L= Latinx; W=White; AsA= Asian American. This classroom map is of one table of 6 persons.

Make a slash mark (/) for every instance of the items in the tool. Try to indicate with short abbreviation of the type of calling on or teacher response that was used (after the slash mark). It will take a bit of practice to get used to the names of calling on (chart below), but this offers precise data with which to have the conversation with the teacher

St 1 (F/AA) /R/CC	St 2 (M/L) /B-I/TR
St 3 (F/W) /R/R/R/R/R	St 4 (M/AsA) /R/TR
St 5 (M/L)	St 6 (F/L)

R*	Raised hand
CC**	Cold Call
CCD	Cold Call for Discipline
B-A	Blurt out-Accepts
B-I	Blurt out-Ignores
C&R	Call and Response: Teacher asks for group response or indicates students should "popcorn"
ES	Uses equity strategy (equity stick or card to call on student)
TR*	Teacher repeats student response to class verbatim
TRV	Teacher revoices student response
TPS	Think and Pair and then Share
Other	Any other strategy you note

R	Raised hand
CC	Cold Call
CCD	Cold Call for Discipline
B-A	Blurt out-Accepts
B-I	Blurt out-Ignores
C&R	Call and Response: Teacher asks for group response or indicates students should "popcorn"
ES	Uses equity strategy (equity stick or card to call on student)
TR	Teacher repeats student response to class verbatim
TRV	Teacher revoices student response
TPS	Think and Pair and then Share
Other	Any other strategy you note

Teacher **Observer** **Date**
Duration of Observation _____ to _____

Student Name OR number	Raised hand **CO: R**	Cold Call **CO: CC**	Cold Call Discipline **CO:CCD**	Calling out **CO: C&R CO: B-A CO: B-I**	Equitable method **CO: ES**	Simple Repetition **TR**	Teacher Revoice **TRV**	Other
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								
14.								
15.								

After the observation using selective verbatim, tabulate the number of instances of each type of calling on.

Teacher **Observer** **Date**
Duration of Observation _____ to _____

R*	Raised hand	Total Number
CC**	Cold Call	
CCD	Cold Call for Discipline	
B-A	Blurt out-Accepts	
B-I	Blurt out-Ignores	
C&R	Call and Response: Teacher asks for group response or indicates students should "popcorn"	
ES	Uses equity strategy (equity stick or card to call on student)	
TR***	Teacher repeats student response to class verbatim	
TRV***	Teacher revoices student response	
TPS	Think and Pair and then Share	
Other	Any other strategy you note	

APPENDIX F: OBSERVATION TOOL: QUESTION FORM

Question Form Protocol

The tool is designed to collect basic information for the teacher to record question forms. Use selective verbatim by selecting and recording teacher questions. Record student code or demographic, but do not collect name. Record time if possible.

Teacher	**Observer**	**Date**
Duration of Observation _____ to _____		

TIME	Teacher Questions	Question Form

Question Form Abbreviation	**Question form explanation**
Y/N ?	Yes/no questions
QW or NQW	Question word (question starts with question word) No question word (question does not start with question word)
FIB ?	Fill in the blank question.
SNA **SNB**	Student name after question Student name before question
TT **NTT**	Adequate Think Time for type of question No think time used
Other	Anything else you observe about question form

APPENDIX G: OBSERVATION TOOL: QUESTION LEVEL

Observation Tool Question Level

The tool is designed to collect basic information for the teacher to see what types (levels) of questioning the teacher is using. **First, use selective verbatim by selecting and recording teacher questions and student responses (use T; or S: to indicate which). If possible, name the student to whom the teacher addresses the question. Second, analyze the evidence using names from the next page.**

Teacher	**Observer**	**Date**
Duration of Observation _____ to _____		

TIME	Teacher Questions and Student Responses (Use T: or S: to indicate speaker)	Level or Type of question

Naming Questioning

Use these names and abbreviations to analyze the selective verbatim evidence for teacher questions and student responses.

Name Level or Type of Question. Use one type of question naming practice for your use with a teacher. You should choose based on the kind of language you use in your school or district or a type you want to introduce and use regularly.

Bloom Revised	**Five Practices Questions**	**Lyman Think Trix**
Remember/Recall Understand Apply	Assessing	Recall Cause/Effect Similarity/Difference
Analyze Evaluate Create	Advancing	Idea to Example Example to Idea Evaluation

If you are developing skills in the question form, you can combine the equity tools of Question Form and Calling On with Questioning Level – access and rigor are in the same observation. Note: WK (Who knows) is an addition from fall Project I[4]

Abbreviation	**Full name**	**Explanation or Definition**
Question Form		
? word	Uses question word	Uses question words to cue students that a question is coming.
Y/N ?	Yes/No Question	The question typically does not start with a question word.
WK	Who knows….?	A question that usually does not elicit student responses/often used in conjunction with hand raising.
FIB ?	Fill in the blank	Typically, the teacher starts to make a statement, but about halfway through the statement then shifts to fill in the blank form of question.
Supports for Students		
TT/NTT	Think time/No think time	Think time of 3-8 seconds depending on question level is typically useful. Takes time for teachers to get students to depend on TT. NTT=no think time before calling on or eliciting response
TPS	Think-Pair-Share	Scaffolding for students to rehearse responses; requires every student response. However, cannot be "sloppy". T. needs to insist on TPS protocol

As you do these processes, you may add other abbreviations and names